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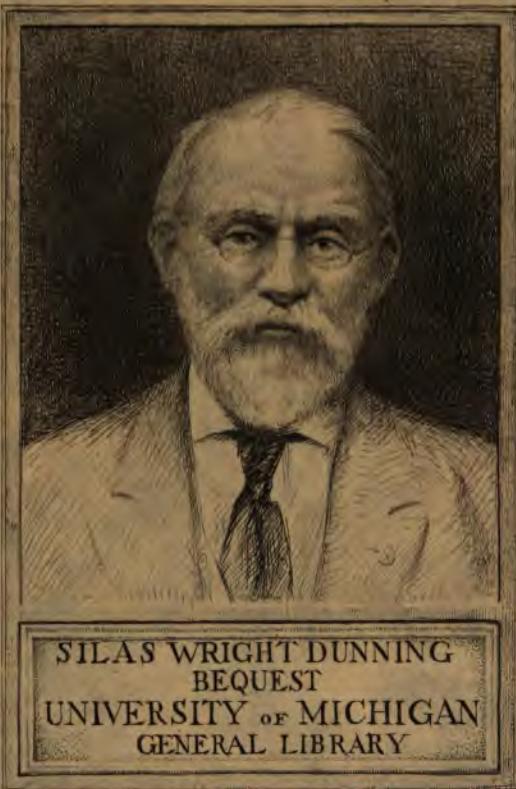
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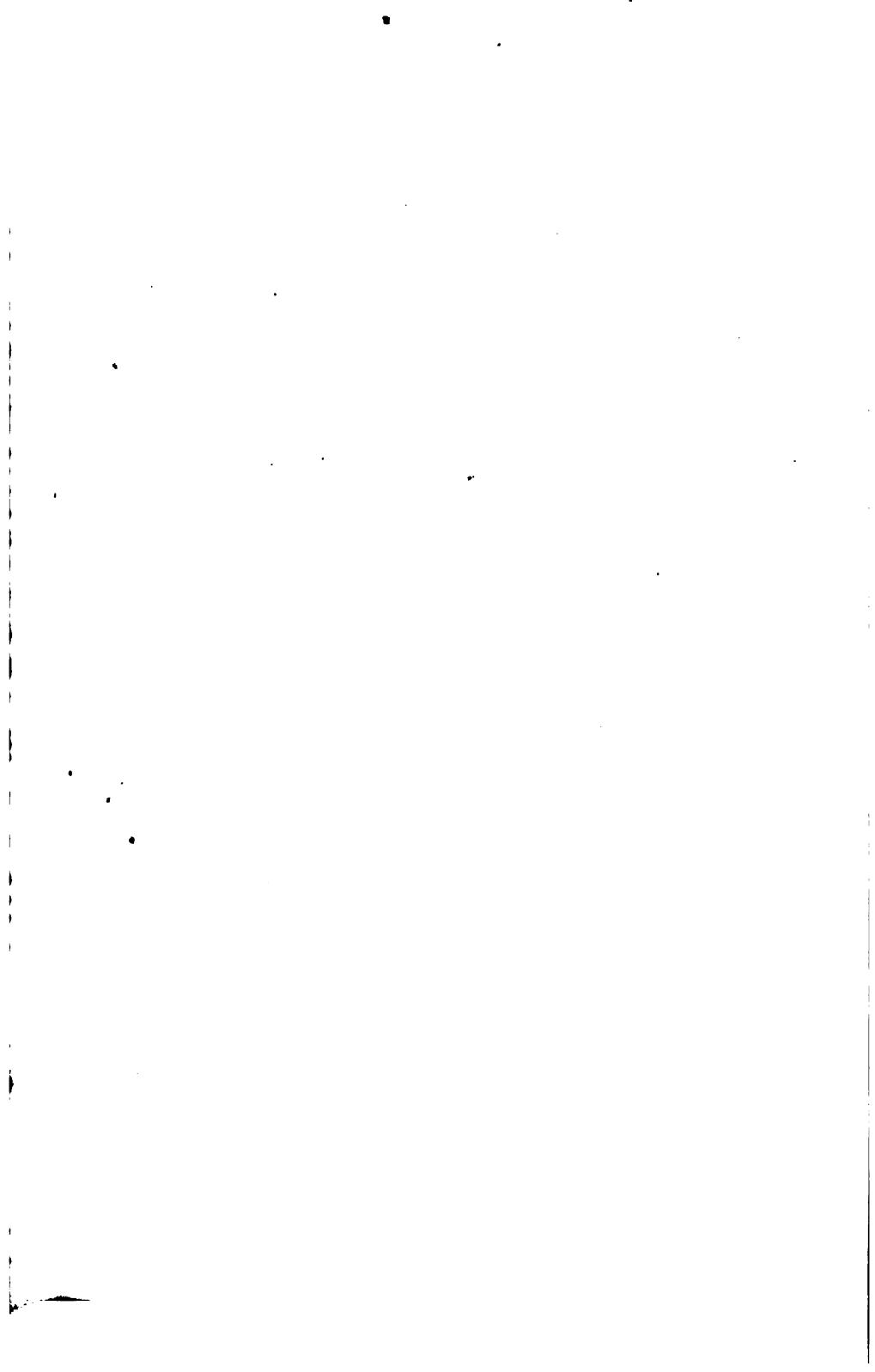


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THE LARVÆ  
OF THE  
BRITISH BUTTERFLIES  
AND  
MOTHS.

BY  
(THE LATE)  
WILLIAM BUCKLER,  


EDITED BY  
H. T. STAINTON, F.R.S. 

VOL. I.

(THE BUTTERFLIES.)

LONDON:  
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MDCCLXXXVI.

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## PREFACE.

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THE origin of the present volume may be briefly stated as follows:

It is the first instalment of the entomological remains of the late William Buckler. WILLIAM BUCKLER was by profession an artist, devoting himself especially to painting portraits and mainly to miniatures. The improvements in photography slowly but surely destroyed the occupation of the painter of miniatures, and William Buckler found when he reached middle life that what had hitherto been his occupation was at an end.

In 1857, the artist who had been for some years depicting the larvæ of Micro-Lepidoptera for the 'Natural History of the Tineina' abruptly discontinued that work and it became necessary to find, with as little delay as possible, a fresh artist.

An urgent appeal was made in the 'Entomologist's Weekly Intelligencer,' of July 11th, 1857 (Vol. II, p. 113), and in answer to that call for help William Buckler replied and offered his services, which were thankfully accepted. He was then residing near Emsworth in South Hampshire (on the very borders of Sussex), and had been for some years devoting his attention to entomology.

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He continued to labour at his new task of painting the portraits of the larvæ of the Tineina with unremitting energy for about three years, but then begged to be relieved of the occupation, as he found it interfered seriously with his time and prevented him from keeping any engagements he might have made with his friends.

The amount of pains and close attention he bestowed on the small larvæ he was figuring has caused many of his portraits to be masterpieces of artistic representation, and had he depicted no other larvæ than those of the Tineina his reputation as an entomological artist would have stood deservedly high.

Before he ceased working for the 'Natural History of the Tineina' he had begun as far back as 1858 to figure larvæ of the larger Lepidoptera for his own amusement, probably at first without any very definite object, but as the numbers of his figures increased he began to take a special interest in obtaining larvæ which he had not previously seen, and owing to the exertions which have of late years been made by many observant entomologists in all parts of the country to obtain deposits of eggs from any female Lepidoptera they happened to capture, many species were seen in the larva state for the first time, and these larvæ thus obtained were carefully figured and in many cases minutely described by William Buckler. I may here mention that in the work of description, Mr. Buckler was, so to speak, self-taught, for living in complete retirement as he did for nearly the last thirty years of his life, he had little access to entomological libraries, where the records of the labours of former workers afford an advanced starting-point for those who can avail themselves of

such help; indeed the increasing mastery he gained over this part of his work can be seen by comparing his earlier and later papers; hence it may be said that at no time were his labours more valuable than just when he was taken away.

It would occasionally happen that in some groups he had already figured the larvæ of all the rarer species before he turned his attention to the commoner kinds, with regard to which the natural feeling prevailed that they could be taken up at any time.

For many years past Mr. Buckler had been in the habit of urging his numerous correspondents to procure for him this or that larva, and when at last some much-desired insect was obtained in the egg state it might chance that a lack of knowledge of the proper food of the larva led to the loss of the young broods after their exclusion from the egg. It will be seen at pp. 113, 114 of this volume that the larvæ of a comparatively common butterfly, *Polyommatus (Lycaena) Ægon*, narrowly escaped starvation from this cause, and to this day some mystery seems to prevail as to the proper food of the larva of the rarer *Polyommatus (Lycaena) Arion*, for though when quite young it eats readily enough the flowers of thyme it seems at a certain stage of its growth to require something else (see p. 190).

Out of the sixty-three species of butterflies which now occur in this country (for I fear that *Chrysophanus dispar* must certainly be looked on as extinct) Mr. Buckler succeeded in figuring the larvæ of fifty-eight; which to all who know the very retired habits of many of these creatures will seem a very large proportion. For three species of larvæ out of the fifty-eight

he was indebted to his Continental correspondents ; it was only in the two or three last years of his life that he had ventured to look across the Channel for help, but it was thus that he obtained the larvæ of *Pieris Daplidice*, *Vanessa Antiopa*, and *Steropes Paniscus*. The five species of our butterflies of which Mr. Buckler never succeeded in obtaining any figures of the larvæ were *Colias Hyale*, *Argynnис Lathonia*, *Polyommatus (Lycaena) Acis* and *Arion*, and *Pamphila comma* ; of these, therefore, there are no figures in this volume.

Mr. Buckler, as will be seen from the letterpress of this volume, had already published in the pages of the 'Entomologist's Monthly Magazine' a number of his descriptions of the larvæ, and these descriptions are here reprinted. But of many species his observations were not sufficiently complete to induce him to lay them before the public, and in this case we have had recourse to his Manuscript Note-Books, and possibly in some cases we may have printed matter which he had no wish should appear in type ; this must always be a difficulty attending any posthumous publication.

When Mr. Buckler died, after a very short illness, on the 9th of January, 1884, it seemed highly desirable that the labours of half a lifetime should not be lost to science, and the Council of the Ray Society entered into negotiations with Mr. Buckler's executor, Mr. James Terry, of Emsworth (with whom he had resided for many years), for the purchase of the drawings and MS. notes. These negotiations were happily concluded and the result is the publication of the first of a series of volumes in which Mr. Buckler's figures and descriptions will be reproduced in a collective and systematic form.

Unfortunately, of many comparatively common species, which had long ago been carefully figured both in the larva and pupa state by William Buckler, no descriptive notes had been published by him, nor were any found amongst his papers; it was necessary, therefore, to try and supply to some extent these omissions.

From the year 1858 down to his death in January, 1884, William Buckler had been in constant correspondence with the Rev. John Hellins, M.A., of Exeter; they studied the larvæ separately, but compared their notes, and before any of Buckler's descriptions appeared in print the manuscript was sent to Mr. Hellins for careful and conscientious revision. The two thus worked together more than is ordinarily the case; of many larvæ Hellins wrote the descriptions and sent them to Buckler for his critical scrutiny, and they were then published under the name of John Hellins.

Hence in the body of this volume the authorship of the descriptions which had been already published pertains sometimes to Buckler and sometimes to Hellins.

The letters W. B. or J. H. after each description indicate the name of the writer; the figures immediately following give the date when the description was written for publication, and the reference that follows is to the volume and page of the 'Entomologist's Monthly Magazine'; thus at page 8, we see "W. B., 28, 2, 82; E.M.M. XVIII, 244;" which stands for "William Buckler, 28th February, 1882; 'Entomologist's Monthly Magazine,' vol. xviii, page 244;" and at page 19 we see "J. H., 14, 12, 69; E.M.M. VI, 232;" which stands for "John Hellins, 14th December,

1869 ; 'Entomologist's Monthly Magazine,' vol. vi, p. 232."

Those descriptions which had not been previously published bear only the references to Mr. Buckler's Note-Books, of which he left four volumes.

To supply the gaps in the present volume, owing to the omission of Mr. Buckler to prepare descriptions of many of the larvæ which he had figured, recourse has been had to the kind services of his former coadjutor, the Rev. John Hellins, who, while the printing of the earlier portion of the volume was in progress, was most assiduous in collecting from many of his friends a mass of material which appears in the Appendix (see pp. 145—198).

In spite, however, of all that Mr. Hellins and his numerous correspondents could do, descriptions of a few larvæ (*Aporia Crataegi*, *Melitaea Cinxia*, *Thecla pruni* and *T. W-Album*) are still wanting, though we give figures of them.

I am well aware that with Mr. Hellins his work in the Appendix has been a labour of love, but none the less do I feel how very, very much we are indebted to him for his valuable aid.

Till after Mr. Buckler's death I was not at all aware that he had ever contemplated the publication of his numerous drawings (altogether he must have executed more than six thousand drawings of larvæ and pupæ), but it seems from some written instructions that he certainly had had such a desire, and the wish, both of Mr. Hellins and myself, has been to render this posthumous work a worthy memento of one whom we loved and esteemed in his lifetime. It is in contemplation to issue, as soon as possible, a second volume

treating of the larvæ of our Sphinges or Hawk-moths.

The plates of the larvæ have been executed by Mr. F. C. Moore, and every attempt has been made to reproduce the life-like drawings of W. Buckler; those who know anything of such work will appreciate the difficulty sometimes felt by our engraver in reproducing *colour-drawings* without the help of the instructions of the artist who made them.

We are much indebted to Mr. G. C. Bignell for the list of parasites bred from the larvæ of our British butterflies which is given at pp. 201, 202.

I have only further to express my thanks to my friend Mr. R. McLachlan, F.R.S., President of the Entomological Society of London, for his kind assistance in various stages of my Editorial labours.

In conclusion, I cannot but remark what a stride has been made in our personal knowledge of the larvæ of our butterflies in this country during the past thirty years, and must tender my best thanks to all who have contributed thereto, and must acknowledge the great amount of pleasure I have derived from their work.

H. T. STAINTON.

MOUNTSFIELD, LEWISHAM;

December 3rd, 1885.

P.S.—In reference to the measurements used in the descriptions, it is almost unnecessary to add—that

a *line* = .08333 of an inch.

a *millimetre* = .03937 of an inch.

	PAGE
<b>Polyommatus Alexis</b>	111
— <i>Egon</i>	112
— <i>Agestis</i> ( <i>Medon</i> )	116
— — var. <i>Artaxerxes</i>	121
<b>Thymelicus Alveolus</b>	123
<b>Thanaos Tages</b>	126
<b>Steropes Paniscus</b>	129
<b>Pamphila Acteon</b>	135
— <i>linea</i>	139
— <i>sylvanus</i>	141
— <i>comma</i>	142
<b>APPENDIX</b>	143
<b>Gonepteryx rhamni</b>	145
<b>Pieris brassicæ</b>	148
— <i>rapæ</i>	152
— <i>napi</i>	156
<b>Anthocharis cardamines</b>	159
<b>Arge Galathea</b>	160
<b>Lasiommata Egeria</b>	163
— <i>Megæra</i>	165
<b>Hipparchia Janira</b>	166
— <i>Tithonus</i>	167
— <i>Hyperanthus</i>	170
<b>Erebia Cassiope</b> ( <i>Epiphron</i> )	171
<b>Cœnonymphia Pamphilus</b>	172
<b>Cynthia cardui</b>	174
<b>Vanessa Atalanta</b>	176
— <i>Io</i>	179
— <i>urticæ</i>	181
<b>Grapta C-Album</b>	182
<b>Thecla betulæ</b>	184
— <i>quercus</i>	185
<b>Polyommatus (Lycaena) Argiolus</b>	188
— <i>Arion</i>	188
— <i>Corydon</i>	191
— <i>Alexis</i>	191
<b>Steropes Paniscus</b>	194
<b>Pamphila linea</b>	195
— <i>sylvanus</i>	196
— <i>comma</i>	198
<b>List of Parasites bred from larvæ or pupæ of British Butterflies</b>	199
<b>INDEX</b>	201

CLASSIFIED LIST OF THE SPECIES  
IN THIS VOLUME.

RHOPALOCERA.

	PAGE	PLATE
<b>Family PAPILIONIDÆ.</b>		
<b>Sub-family PAPILIONIDI.</b>		
Papilio Machaon . . . . .	1	I, fig. 1
<b>Sub-family PIERIDI.</b>		
Gonepteryx rhamni . . . . .	145	I, fig. 2
Colias Edusa . . . . .	9	I, fig. 3
" Hyale . . . . .	16	No figure
Aporia cratægi . . . . .	No description	II, fig. 1
Pieris brassicæ . . . . .	148	II, fig. 2
" rapæ . . . . .	19, 152	II, fig. 3
" napi . . . . .	20, 156	II, fig. 4
" Daplidice . . . . .	21	III, fig. 1
Anthocharis Cardamines . . . . .	159	III, fig. 2
Leucophasia sinapis . . . . .	25	III, fig. 3
<b>Family NYMPHALIDÆ.</b>		
<b>Sub-family SATYRIDI.</b>		
Arge Galathea . . . . .	160	III, fig. 4
Lasiommata Ægeria . . . . .	27, 163	IV, fig. 1
" Megæra . . . . .	165	IV, fig. 2
Hipparchia Semele . . . . .	28	IV, fig. 3
" Janira . . . . .	166	V, fig. 1
" Tithonus . . . . .	167	V, fig. 2
" Hyperanthus. . . . .	170	V, fig. 3
Erebia Blandina ( <i>Medea</i> ) . . . . .	30	VI, fig. 1
" Cassiope ( <i>Epiphron</i> ) . . . . .	33, 171	VI, fig. 2
Cœnonympha Davus . . . . .	35	VI, fig. 3
" Pamphilus. . . . .	172	VI, fig. 4
<b>Sub-family NYMPHALIDI.</b>		
Limenitis Sibylla . . . . .	36	VII, fig. 1
Apatura Iris . . . . .	42	VII, fig. 2
<b>Sub-family VANESSIDI.</b>		
Cynthia cardui . . . . .	49, 174	VIII, fig. 1
Vanessa Atalanta . . . . .	176	VIII, fig. 2
" Io . . . . .	179	VIII, fig. 3

		PAGE	PLATE
<b>Sub-family VANESSIDI (<i>continued</i>)—</b>			
Vanessa Antiopa . . . . .	52	...	VIII, fig. 4
“ Polychloros . . . . .	54	...	IX, fig. 1
“ urticæ . . . . .	55, 181	...	IX, fig. 2
Grapta C-Album . . . . .	57, 182	...	IX, fig. 3
<b>Sub-family AEGYNNIDI.</b>			
Argynnus Paphia . . . . .	58	...	X, fig. 1
“ Adippe . . . . .	65	...	X, fig. 2
“ Aglaia* . . . . .	71	...	X, fig. 3
“ Selene . . . . .	73	...	XI, fig. 1
“ Euphrosyne . . . . .	77	...	XI, fig. 2
Melitæa Cinxia . . . . .	No description		XI, fig. 3
“ Athalia . . . . .	81	...	XII, fig. 1
“ Artemis . . . . .	84	...	XII, fig. 2
<b>Family ERYCINIDÆ.</b>			
Nemeobius Lucina . . . . .	85	...	XII, fig. 3
<b>Family LYCAENIDÆ.</b>			
Thecla betulæ . . . . .	184	...	XII, fig. 4
“ pruni . . . . .	No description		XII, fig. 5
“ W-Album . . . . .	No description		XIII, fig. 1
“ quercus . . . . .	185	...	XIII, fig. 2
“ rubi . . . . .	89	...	XIII, fig. 3
Chrysophanus Phleas . . . . .	91	...	XIII, fig. 4
Polyommatus ( <i>Lycæna</i> ) Argiolus . . . . .	94, 188	...	XIV, fig. 1
“ ” Alsus† . . . . .	100	...	XIV, fig. 2
“ ” Arion . . . . .	105, 188	...	No figure
“ ” Corydon . . . . .	191	...	XIV, fig. 3
“ ” Adonis . . . . .	106	...	XV, fig. 1
“ ” Alexis . . . . .	111, 191	...	XV, fig. 2
“ ” Egon . . . . .	112	...	XV, fig. 3
“ ” Agestis ( <i>Medon</i> ) . . . . .	116	...	XVI, fig. 1
“ ” var. Arta- . . . . .	xerxes 121	...	XVI, fig. 1
<b>Family HESPERIDÆ.</b>			
Thymele alveolus . . . . .	123	...	XVI, fig. 2
Thanaos Tages . . . . .	126	...	XVI, fig. 3
Steropes Paniscus . . . . .	129, 194	...	XVII, fig. 1
Pamphila Actæon . . . . .	135	...	XVII, fig. 2
“ linea . . . . .	139, 195	...	XVII, fig. 3
“ sylvanus . . . . .	141, 196	...	XVII, fig. 4
“ comma . . . . .	142, 198	...	No figure

\* *Argynnus Lathonia* does not occur in this volume, Mr. Buckler never having obtained either eggs or larva.

† *Polyommatus (Lycæna) Actis* does not occur in this volume, for the same reason above mentioned.

# THE LARVÆ OF THE BRITISH BUTTERFLIES.

---

PAPILIO MACHAON.

Plate I, fig. 1.

IN offering my notes on this history of this species, I know I am going upon ground to some extent already well trodden, and it is, therefore, not on the plea of telling anything quite new that I put them forward ; but, knowing that there is now, more than ever, an interest felt in obtaining exact information as to the process of growth or development in the earlier stages of various forms, and being conscious that I have done my best in this case, I still hope that my work may be of use ; I only wish I could impart to others anything approaching the pleasure I myself felt in watching and recording what follows.

In 1868 I had reared the larvæ from two eggs found in Burwell Fen by Mr. W. R. Jeffrey, and two more in 1871 from eggs found by Mr. C. G. Barrett in Horning Fen, and had taken several figures in either case, but when, in 1879, Mr. W. H. Edwards, of Coal-burg, West Virginia, put some questions to me on the number of moults and other points connected with them, I found I could not give such positive answers as I could have wished.

I determined, therefore, if possible, to rear the larva again, and Mr. W. H. B. Fletcher most kindly helped to bring my project within range of possibility by

sending me three eggs on June 4th, 1880, which he had found the day before in Wicken Fen, and on the 12th a few more, laid on *Peucedanum palustre*, but eventually three of these proved infertile.

What follows is, of course, really the personal history of the individuals which I watched, and though for convenience sake I shall generalise, and sometimes use the present tense and not the past, I wish it to be understood that I speak only of what I was aware I saw : I know I made one omission, which will be noticed in its proper place.

The eggs hatched June 13th—15th, the larvæ in every case making their first meal of the empty shell, and for a day or two I supplied them with garden carrot, but after that they were fed entirely on *Angelica sylvestris*. From first to last each larva was kept separate, and its changes noted in a separate record.

The larva, on first turning its attention to its food-plant, scoops out a round cell on the surface of a leaf, but after a few hours takes the bolder course of eating quite through from the edge of the leaf. It does not roam, but continues at the same part till the third or fourth day, when it moves off to some distance, and on a stalk or leaf spins a few silk threads for a foot-hold ; there it waits from two to three days for the first moult, and when this is accomplished eats the cast skin all to the head-piece, and soon after goes—apparently by design—back to the spot where it was previously feeding and attacks the leaf again. At this stage I noticed that if a larva found a speck of “frass” on its food, it would pick it up in its jaws, stretch out its body, and somehow project the “frass” away from the plant. Again, after feeding three or four days it retires as before, and prepares for and accomplishes its second moult, which happens on about the twelfth day of its life. Similarly the third moult comes on the sixteenth or seventeenth day, and the fourth (the last) from the twentieth to the twenty-third day, the cast skin being always eaten. After the

last moult the larva feeds on for ten or twelve days, consuming a great quantity of food, and making very rapid growth. I may here note that its usual attitude in repose is from the very first much like that of a *Sphix* with the neck arched and the head bent down.

The earliest age at which I noticed the curious horns of the second segment was when I touched the larva just after its third moult ; they were then much longer and thinner than they became after the fourth moult, but there accompanied their protrusion a drop or two of clear greenish liquid, and a most penetrating odour, which reminded me of an over-kept decaying pineapple. After the fourth moult the horns were of a shorter and stouter character, but I observed that when I was holding a larva between my finger and thumb it had the power to lengthen one horn at the expense of the other (which became shorter) so as to manage to touch my finger with it ; the horns are extremely soft and flexible.

When full grown the larva ceases feeding and rests for a while, and then commences its preparations for pupation by selecting a stem and spinning on it from side to side a number of threads to ensure a good foot-hold ; next, lying along these threads head downwards, it spins at the bottom of them a broad cone of whitish silk, having a sharpish apex ; then, turning round, it creeps up the stem a little and with the anal prolegs feels about till they find this cone, when they are placed close together on the stem but touching the base of the cone, and a slight pushing motion is visible by which their circlet of hooks is fixed in the silk spun on the stem. Its tail end being thus fixed the larva stretches out its head and front segments, lifting up at the same time the first and second pairs of ventral feet, and bends itself backwards in a wide sweep from one side of the stem to the other, as though to be assured there is free room for its movements. It next—while in this semi-detached attitude, and with its thoracic legs rigidly

extended—throws back its head, and in this way swells out its breast like that of a pouter pigeon, leaving a deep hollow between the mouth and the first pair of thoracic legs ; then it bends to one side of the stem and spins a broadish attachment for the first thread of the cincture, and presently with a slow and deliberate motion sweeps round as before to the other side, the head all the while wagging as the silk issues from the spinneret and is guided along the hollow above mentioned. As the head approaches the other side the body swells out still more, as though to stretch the thread and give it the necessary curvature. As on commencing the thread, so now on fastening it to the other side, there is delay for a little and the fastening seems to be made with a more liquid and glutinous quality of silk than the rest of the thread. The first thread thus completed, the larva proceeds in the same slow and methodical manner, spinning some thirty threads from right to left, and as many from left to right, or sixty altogether for the cincture, the time thus occupied being about one hour and forty-five minutes ; occasionally the first pair of thoracic legs seem to be made use of to assist at the fastening of the ends of the threads. When enough threads have been spun the larva seems to test their strength by pulling them quite taut with its projecting breast, two or three times, and then, apparently satisfied, it bends down its head to put it under the cincture, and creeps up inside it till it hangs loosely round its back between the sixth and seventh segments ; next it seems to relieve itself by stretching upward all the front segments that had been so engaged during the spinning, and in a few minutes settles into a quiet posture, with head bent down and legs brought close to the stem.

Thus it rests, and meanwhile the segments of the body shorten and their divisions deepen ; the head becomes bent down close to the stem, while the body is held away from it as far as the cincture allows, drawn tight as it is into the deep division between the sixth

and seventh segments, so that only the head and tail are in contact with the stem. At the end of about a day and a half suddenly the head and front segments are jerked backwards four or five times in succession, next the belly is brought close to the stem and the head held up, and then in about five minutes the skin splits open behind the head on the top of the back, and the pupal thorax appears bulging out; presently is disclosed the top of the head, then the upper part of the face, and with a few nodding motions the head is freed, and the skin slowly but easily slides downwards from each side (the cincture causing not the least impediment), and as it goes drags away like little threads the linings of the spiracles. Presently from out of the collapsing skin is disclosed the tip of the tail, and there is just time allowed for the observer to see that it is quite *hollow*, when in another moment it is fitted upon the *cone* of silk and strongly pressed down, and with a repeated half-screwing motion the attachment is made complete; meanwhile the moisture which exudes from the pupal surface has surrounded and fairly embedded the cincture at its line of contact with the back.

The old shrivelled skin now rests in a heap between the lower part of the abdomen and the stem, but is presently, by a slight twisting movement on the part of the pupa, caused to drop off; the head and thorax gradually develop themselves, the former into two largish blunt diverging processes, the latter into a central bluntly projecting eminence, with another on either side; the larval tubercles remain as small blunt conical protuberances, the wing-covers form an angular outline, and the back becomes dull and rough; just four minutes elapse from the bursting of the larval skin to the full disclosure.\*

The egg of *Machaon* is globular, having a depression at the base in contact with the leaflet on which it

\* I must express my regret that I forgot to look for the connecting membrane, which was discovered in *Pieris* and *Vanessa* by Dr. Osborne,

adheres ; it is of a good size and with apparently smooth surface, and when first laid is of a greenish-yellow colour quickly turning green, and soon after tinged with violet-brownish, gradually deepening to purplish, and faintly showing the embryo through the shell, which in a day or two turns entirely purplish-black, a process of change similar to that shown by a ripening black currant. The shell next assumes a light pearly transparency, and the dark embryonic larva coiled round within is plainly visible, and in a few hours hatches.

The newly hatched larva is 3 mm. long, stoutish, with shining black head and black velvet body with dark green segmental divisions, and conspicuously marked with a patch of creamy-white on the seventh and eighth segments. The pale pinkish tubercles, in some instances yellowish, rather bristly, are in two rows down either side, and in about eight hours turn dark drab, and in a day or so blackish like the third row beneath, except those on the white patch which remain white.

After the first moult, in three days the length is 8 or 9 mm., the stoutness in proportion ; the head black and the body velvety-black bearing two orange dots on the front margin of the second segment ; the shining, rather pointed, black tubercles having their bases reddish-ochreous, after being for a day or so green ; the white patch as before, but now bearing black tips on the tubercles.

After the second moult, the length by the third day has increased to 14 mm. with increase of stoutness ; the black shining head is marked on the face with a yellow chevron, and with pale yellow upper lip and bases of papillæ ; the black velvety body has the white patch yet more conspicuous and encroaching a trifle on the ninth segment ; the front dorsal margin of the second segment is marked with orange-yellow, and

and described by him in the 'Entomologist's Monthly Magazine,' vol. xv, page 59.

minute twin dorsal bright yellow dots are on the third and fourth, and a faint, narrow, transverse divisional streak of yellowish or greyish between them; other similar short streaks occur on the ninth and tenth. Of the three rows of conical black tubercles on each side of the body, the two top rows have their upper bases half ringed with bright orange colour (excepting those on the white patch, which have pale yellow), the lower third row have orange bases like slanting slashes; the anterior legs are whitish, tipped and spotted above with black, each ventral proleg with a white crescentic mark above the foot; and there is some white on the anal flap.

After the third moult, in two or three days the length is 22 mm. and the thickness in proportion; the design, now more developed, shows the head yellow marked with black, and the horns when protruded are orange-red; the ground colour is of the palest greenish-yellow, though it is still white on the seventh and eighth segments, but showing only in transverse rings a little wider than the very narrow greenish-yellow ones round the others; for the middle of each segment is transversely banded with velvety-black, but more narrowly on those two with white ground. The segmental divisions are greyish-black; the black velvety bands are intersected by three lines of the ground colour bearing the orange tubercles with black bristly apices, except on the thoracic segments, where the black bands are broadest and only broken below, as on them the upper tubercles are completely surrounded with black; all the legs are white marked with black.

After the fourth moult, the length in two days is 31 mm., and in five more days is 46 mm. and very stout; its size and beauty of colouring being now at their greatest. The thoracic segments swell upwards in a rounded arch from the fourth which is the largest, and viewed from above sharply taper thence to the head, which is the smallest and bends downwards. The colour of the head is bright yellow with a black oval spot on the

face and two black streaks down either side, the ocelli in a black patch below, the mouth marked with black in the centre and on each side, papillæ whitish. On the front marginal ridge of the second segment occur two orange spots and two black spots in front of them close to the head, and between these pairs of spots is the concealed orifice whence the retractile soft fleshy horns, of pinkish-red colour, dart forth when the larva is irritated; and when seen at this period they are uniformly stout with blunt diverging extremities. The ground colour of the smooth skin of the body is a very brilliant pale yellow-green, becoming white on the belly and ventral feet; the segmental divisions widely banded with deep purplish edged with velvety black, and across the middle of each segment is a broad velvety-black band, covered with excessively fine bristly pubescence and bearing the orange tubercle of the upper row near the front margin, and sometimes also that of the middle row; but generally this transverse black band is interrupted by an isthmus (so to speak) of the ground colour which bears this tubercle; and below there is always a slanting isthmus of ground colour bearing the lower tubercle. On the third and fourth segments the broad bands have only this lower interruption, and bear the orange warts of the two upper rows (here diminished in size) in their middle. The anterior legs are white with black tips and joints; the ventral prolegs have each a narrow streak in front, a spot behind, and a large crescentic mark of black above the white feet, which have dark hooks. On the anal prolegs this black mark is purplish in the middle. The spiracles are of a blackish-slate colour, situate within the lower parts of the black bands; the whitish belly has a central series of blackish blotches and narrow transverse bands in the deeply-sunk divisions.

The pupa, when come to its full colour, is pale yellow on the back and abdomen and delicate light green on the head and wing covers. (W. B., 28, 2, 82; E.M.M. XVIII, 244.)

## COLIAS EDUSA.

## Plate I, fig. 3.

On the 10th of June, 1867, my friend Mr. James Terry, brought me a fine ♀ of this species that he had caught with his hat. It measured  $2\frac{1}{2}$  inches in expanse of wings, and had evidently been, before hibernation, a splendid insect, though it was then in a worn and ragged condition.

I placed the butterfly on a plant of Dutch clover (*Trifolium repens*) and stood it in a window facing the west, and supplied it with a little honey and water; two days later I had the satisfaction of seeing ten eggs. The insect was then removed to fresh plants of clover, but the day following being dull and cloudy, no eggs were laid; the two succeeding days, however, proving bright and sunny, she recommenced laying, and deposited about forty or more eggs. The weather again becoming dull, there were no additions till the 18th, when on fresh plants another large batch of eggs was distributed; the following day the insect expired, after depositing the final egg on a spray of *Lotus corniculatus*, placed with the clover as an experiment.

The eggs were oval, but very sharply pointed at each end, and were laid on the upper surfaces of the leaves in an upright position, standing on end. They were shining and at first whitish-yellow, rapidly turning darker yellow, changing by the fourth or fifth day to reddish and in ten days to pink.\*

The young larvæ were at first of a pale brown and afterwards dull green; some were bluish-green, and all with a line of whitish along the spiracles, then and afterwards assimilating well with the clover, of which they ate voraciously. Probably during my absence the

\* At that time being obliged to leave home, I had not the satisfaction of seeing the young larvæ when first hatched; but reports of their progress were duly sent to me, whereby I became aware of their beginning to hatch out on the 24th of June.

supply of food had not been equal to the demand, for when I saw them, on the 6th of July, their numbers had greatly decreased and the survivors were clustering on the bare stems of the plants they had stripped in the course of the day.

From that time they were abundantly supplied with fresh food, and though their progress seemed satisfactory, it soon became evident that they had not been able to recover the check sustained when young, for they began to suspend themselves from July 16th, and change to pupæ before attaining the size I had hoped for.

The first perfect insect came forth on the 6th of August, and the others followed during about a week. They were most lovely examples of colour but smaller than ordinary captured specimens.

After the young larva became green, they so remained through all their subsequent moultings, and no variety worth mention occurred in the brood. Their habits were rather sluggish, especially as they matured. The size attained by the largest was little more than one inch and a quarter in length, moderately stout, of nearly equal size throughout, rounded above and rather flattened beneath, the head globular and rather smaller than the second segment. The segments subdivided by transverse wrinkles or folds into six portions, the second portion the widest.

The colour was a deep, dull grass-green, the dulness being caused by their being irrorated with excessively minute black points; and each point emitting a very short fine hair, added a velvety appearance to the surface of both head and body.

In some examples a darker dorsal pulsating streak was visible, though in general hardly noticeable.

The larva was adorned with a whitish or else a yellow spiracular stripe, which was further embellished on each segment by a pink or red blotch in the middle of it and a black spot immediately under it, while a little in advance of the red was seen the oval whitish

shining spiracle. The legs and ventral surface were similar to the back.

The pupa was attached by the tail and with a cincture of silk thread around it close below the thorax, after the manner of the *Pieridi*; the head was generally upwards, though in some cases a horizontal position, or nearly so, was chosen.

The pupa is moderately stout; the thorax round and projecting on the back; the head terminates in a sharp point; the wing-cases are long and well developed, projecting below the abdomen. The colour of the back and body a very pale yellow-green, with a pale yellowish stripe on each side below the wing-cases on the abdomen; on the underside, beneath them, are three minute black dots, followed by a stripe of dull dark red. The wing-cases of a rather deeper and yellower green, which a few hours before the insect emerges become suffused with red. In the centre of each wing is a minute black dot and a row of fine similar dots near their lower borders. The point at the top of the head is dark olive-green above, sharply contrasted on the underside with pale primrose-yellow, and both gradually blending into the colours below. (W. B., 9, 67; E.M.M. IV, 117.)

In the neighbourhood of Emsworth, Hampshire, *Colias Edusa* appeared in great numbers during the first fortnight of June, 1877, culminating perhaps on the 11th of the month, when they were seen in all directions.

The fields of clover and *Trifolium* in blossom seemed very attractive to these butterflies, and it was not uncommon to see them flying at each other; once on the 11th I saw as many as six together in a confused flight, rising and falling by turns as they seemed battling together. I also saw one captured by a swallow. (W. B., E.M.M. XIV, 40.)

On the 12th June, 1877, the Rev. E. T. Daubeny, of Bedhampton, kindly brought me a female he had captured, after seeing her deposit a couple of eggs on a

spray of *Lotus corniculatus*, of which I at once had a small plant potted and the butterfly placed on it and exposed to the sunshine, when she recommenced laying eggs, and by 5 p.m. had deposited more than 150; the next day was cloudy and none were laid until 4.30 p.m., when this female and another recommenced laying on another plant of *Lotus corniculatus*.

This individual female seemed certainly worn, nevertheless I strongly incline to the belief that by far the greater number of those I saw on the wing at this time must have passed the exceptionally mild winter in the pupa state.

The two eggs Mr. Daubeny brought me hatched on the evening of the 16th, those laid on the 12th began to hatch on the morning of the 18th June.

The newly-hatched larva is olivaceous, suffused with deep pink, or it may be called pinkish-brown, the head dark or blackish brown. The young larva remains on the leaf on which it was hatched, and on which it begins to feed, only wandering to another leaf when too many larvæ happen to be together. It is very quiet and still and eats white transparent blotches on the leaf.

On the 21st of June, those first hatched had just passed their first moult; their heads now appeared smaller in proportion to the body, which was longer and more velvety green, though still showing some of the pinkish-red tinge.

At the next or second moult, which with the earliest examples commenced on the 25th, the colouring becomes darkish green, matching very well the colour of the leaf on which they feed; for a few hours the head was paler, but soon after it became green like the body.

By the 5th of July some had moulted the third time and were now half an inch in length and at first *dark* velvety-green, becoming gradually rather lighter green and showing the pale spiracular line. By the 18th some had moulted a fourth, others even a fifth time,

and were from three-quarters of an inch to one inch in length, whilst others were still small, under half an inch in length.

On the 19th of July two friends, while gathering some of the food-plant for me near the shore, found a larva of *Edusa* on it, more advanced than mine reared from eggs in captivity, and this larva had spun up on the 25th and was a pupa on the 29th.

On Monday the 6th of August, 1877, hearing that the second brood of *Colias Edusa* was flying in great profusion about the clover fields, I induced a friend to net me a few of the shaggiest females he could meet with, and he returned with about a dozen for me and as many perfect specimens for himself, and amongst them a lovely specimen of the variety *Helice*. He reported them to be in great abundance all over the field he visited.

On the spur of the moment I utilised a little fresh-gathered *Lotus corniculatus*, placed in bottles of water and covered with glass cylinders, and also a growing plant on which the larvæ of the first brood were still feeding protected by a covering of grenadine. By the evening I observed one of the best conditioned females had laid nine eggs on the *Lotus* in a bottle of water; to these she added a few more, and when the larvæ began to hatch these little sprays were placed in the middle of two fine plants of *Lotus* growing in pots for the larvæ to find their food; these were uncovered and placed in a window, and between them stood a small pot of common clover on which the butterfly had been kept a day or two and deposited several eggs before she was set at liberty. Without further attention the larvæ throve, wandering occasionally from one pot to the other; sometimes I saw an individual or two on the window-curtain, on the sill, or on the floor, but not often.

Their growth was very different; the most forward had completed their last moult by September 21st, while others were not more than half an inch long.

They continued to feed and grow, consuming a great deal of food, stripping bare the stems of plant after plant, appearing to be very hardy, not flinching in the least from any amount of water poured over them when the plants were being watered, apparently not noticing it in the least. On the approach of cold frosty nights they remained stretched out still and passive, seeming to feed only by day.

On the 15th of October I found that one had changed to a pupa on the bottom of the window-frame in a horizontal position; two full-fed larvæ had also crawled on to the perpendicular frame of one of the lower panes of the window, another also on the corresponding frame of the same pane. On looking the next day I saw that this one was head downward, but the following day it had its head upward like the other two larvæ, which still remained and were indeed fixed, their cinctures being distinctly seen.

October 22nd.—I happened during the morning to look at one of the two spun-up larvæ above mentioned, and saw that its head was no longer bent down but stretched out in a line with the body, and that it was moving it forwards and from side to side. In a few seconds the skin broke away from the back of the head in the centre, and split open down the centre of the back, from which it slid away down each side, exposing four segments of the soft yellow-green surface; and now the head-piece split in two from the crown to the mouth, each half seemingly pushed aside by a conical projection growing rapidly out of each cheek. A few heavings of the front parts soon caused the larval head-piece to shrink away from the head of the pupa, still attached to the skin, which kept sliding away downwards and backwards; after the skin had slid away from under the cincture on the back, a heave upwards of the larva caused the cincture to sink in and, as it were, to become firmly embedded in the yet soft surface of the pupa. Up to this point the operation had lasted seven minutes.

The hinder segments now continued to heave a little, which brought the old skin of the larva farther and farther behind, until at length, with a slight dexterous twist, it came off the last segment and remained shrivelled up close to the tail of the pupa. Four minutes more had now elapsed, and presently the beak was by degrees developing itself in front of the head, while the keel of the thorax became more and more sharply prominent, and the projections previously noticed at the cheeks took the less prominent and rounded form of eye-covers; the leg and antenna-cases, which hung down in high relief at their first disclosure, were now sunk back, as it were, to the more level surface of the breast of the pupa; at the same time the divisions of the upper segments closed up, and the wing-covers swelling out assumed their proper contour.

These adjustments and the consolidation of the form and skin of the pupa occupied an additional twenty minutes.

Another larva assumed the pupa form the following day, and by the twenty-seventh eight other larvæ had spun themselves up.

About the 10th of October (1877) Mr. C. G. Barrett captured a female *Edusa* near Pembroke; he placed her on clover under gauze in his garden, and on the 12th of October she laid some eggs, which I received from him the following day. These eggs hatched on the 27th of October. The young larva made its first meal of the egg-shell it has quitted, leaving only just the lower end of the shell uneaten. (W. B., Note Book III, 187.)

## COLIAS HYALE.

(One of the few larvæ of which there is no figure in this volume.)

One egg, which had been laid loose, I received September 8th, 1875, from Mr. E. F. Bisshopp. It was apparently smooth, but really ribbed and of a pale canary-yellow colour, reminding one of a canary-seed in miniature. This egg proved infertile and shrivelled within twelve days.

Six more eggs were sent me by Mr. Harwood, of Colchester, on the 16th of September, 1875; they were laid on a spray of *Medicago sativa*; they were in shape and colour as above mentioned, with longitudinal ribs; they began to turn pinkish on the 20th, and three of them scarlet on the 21st, and dark grey a few hours before hatching on the morning of the 22nd.

The young larva was of an ochreous greenish colour, with the rough head purplish brown, nearly black; there was a faintly dark greenish sub-dorsal stripe on either side of the back.

They fed on the cuticle of the upper side of the leaves of lucern, forming small transparent blotches, and it was noticeable that each larva remained on the identical leaf where it was first placed, and each time fresh food was given they had to be removed to it. On the 4th of October they moulted the first time.

On the 12th of October they had grown but little, and were little more than one-eighth of an inch long, of a dingy green colour, with a slightly paler greenish sub-dorsal line and a faintly darker dorsal line, the spiracular stripe of a paler greenish than the ground colour, the entire surface sprinkled over with fine bristly blackish hairs, the head rounded and bristly. At this time they ate little holes through the leaves between the veins.

By the 21st of October all three had got over their second moult, and were of a darker full green than

before ; the markings much the same, but the dark bristly hairs more conspicuous. They continued to feed in the same way as before until November, and then more and more sparingly until the 18th, when I found the largest was dead ; it was just a quarter of an inch long and very bristly. Another died December 12th, and the last on the 28th of December, from mildew on the two hinder segments. (W. B., Note-Book III, 32.)

On the 27th of July, 1882, I received four eggs of *Colias Hyale* from Herr Heinrich Disqué, of Speyer, they were adhering to the leaflets of *Trifolium*. Two hatched in the morning of the 1st of August, another at noon that day, and the fourth two hours later. The larvæ were offered *Medicago lupulina* and *Trifolium repens*, and chose the latter plant, each taking a position on the midrib on the upper side of a leaflet, from which they moved to the right or left occasionally to feed, at first by eating away small portions of the cuticle between the veins, and the next day they ate small holes quite through the leaves between the veins ; these larvæ were as before described. On the 9th I noticed that they had passed their first moult, the day previously at least, perhaps earlier. The head was now coloured like the body, which was of a very deep and dingy green with a faintly darker dorsal stripe, and the spiracular stripe scarcely paler than the ground colour, the entire upper surface being thickly covered with a roughness of minute black bristles ; at this time the length was  $4\frac{1}{2}$  mm.

On the 11th one was laid up to moult, and on the 14th had moulted during the previous night ; on the 15th I observed its head to be rather lighter green than the body, which was very dark and dingy, relieved by a yellowish spiracular line ; the surface of the skin was thickly covered by minute, pale, tubercular, glistening specks, each bearing a short, pointed, black bristle. On the 21st all the larvæ had been for two or three days laid up to moult, and in the morning of

the 22nd one had moulted for the third time; it was then of a lighter green, but with other details much as before; the pale yellowish-white spiracular stripe was softened above into the green ground colour, but below it contrasted abruptly with the colour of the ventral surface; the head and all the surface of the body were thickly set with short, pointed, black bristly hairs.

Of the others one moulted a third time on the 23rd, and another on the 26th. The most forward measured by the 27th four lines and was thick in proportion, the spiracular line very pale whitish-yellow, the spiracles being outlined with black and situated on its lower edge; other details as before.

All began to hibernate towards the end of September, but after a few weeks' quiet they one by one died off.

Of four other larvæ which had hatched much later from a second batch of eggs received from Herr Heinrich Disqué, which had been kept openly on a potted plant of Dutch clover, I lost two after their second moult by their wandering away from the plant; the two remaining larvæ were then placed under gauze, and they in due course moulted a third time and fed away in October, but first one and then the other died towards the end of that month.

It seems thus impossible to rear this larva in autumn, the only chance would be to obtain eggs of an earlier brood if possible. (W. B., Note-Book IV, 163.)

On the 13th of August, 1868, Mr. A. H. Jones most kindly sent me more than twenty eggs which he had obtained from a captured female, and although I failed with the larvæ, yet I think my experience may be of benefit to anyone who may have the same chance another time.

The larvæ were hatched August 17th to 20th, first ate their egg-shells and then settled on *Medicago lupulina*, in preference to *Lotus corniculatus*, *Trifolium repens* and *pratense*, with all of which I supplied them.

They grew slowly, dying off one by one, till the three or four survivors were about one-third of an inch long, at which size they hybernated, but never began to feed again in the spring, and so perished in February and March, 1869. Perhaps the right way would have been to have kept them in a greenhouse, and fed them up rapidly without hybernation.

The egg is of a long fusiform shape, one end conical, the other knobbed or like a bag tied round the neck ; the shell delicate and glistening, ribbed longitudinally and with very slight transverse reticulations ; the colour, at first a pale straw, changing to rich apricot or salmon colour, and lastly blackish.

The newly hatched larva is of a very pale olive freckled with brownish ; head as wide as the body and blackish ; on each segment a transverse row of clubbed pellucid bristles. After a moult it becomes pale yellowish-green, and after another a full green. And from this time to their early and lamented death my larvæ remained as follows :

Length about one-third of an inch, stout, cylindrical, uniform in bulk, head narrower than the second segment. Colour a dull full green, head slightly tinged with brown, a whitish spiracular line, the whole skin covered closely with short black spines or bristles. (J. H., 14, 12, 69 ; E.M.M. VI, 232.)

#### PIERIS RAPÆ.

#### Plate II, fig. 3.

A full-grown larva was found on a garden wall, September 17th, 1874. Its length was  $1\frac{3}{16}$  inch, tapering a little behind and a little in front, the head globular. Its colour was a dull velvety, rather glaucous green on the upper surface as far as the spiracles, thence becoming rather paler. The dorsal line was of a deep, rather orange yellow, ending on the twelfth segment, and there

were two spots of this colour on each segment along the spiracular region, the spiracle itself being situated in the middle of the anterior spot ; it was dark red outlined with black.

The green surface was thickly sprinkled with minute black points of two sizes, the smallest required the aid of a lens to be seen ; these appeared to have no regular order beyond a tolerably equal distribution (no pale dots visible). The black dots did not extend very far below the spiracular region ; each emitted an extremely fine pale hair ; low on the side above the legs the hairs were paler and longer.

The green head was also thickly set with fine short, pointed black hairs.

The subdivision of the ordinary segments was into six rings, but they were by no means conspicuous. (W. B., Note-Book II, 124.)

#### PIERIS NAPI.

##### Plate II, fig. 4.

On the 28th of June, 1874, I found larvæ of this species on *Hesperis matronalis* ; they were then half an inch long, but they grew very rapidly, and by the 3rd of July they had attained their full size of one inch and one line.

The form was cylindrical with the head rounded ; the skin soft and velvety looking, of a rather deep glaucous green, with the dorsal surface irrorated as far as the spiracles, with very minute black points, each emitting a fine short hair ; the usual tubercular dots (*i.e.* the trapezoidal and transverse thoracic series of threes on either side and one on the side of the other segments above the spiracles) were greenish-white.

Below the spiracles the ground colour is rather paler than on the dorsal surface, a faintly paler spiracular line separating the paler from the darker green ; on

this line the black spiracles are placed, each in a round, rather tumid, deep yellow spot. Below the spiracular line there are sprinkled some greenish-white (or whitish-green) dots with hairs rather longer than those on the back; the head is of a more yellowish-green than the body and is marked with black above the mouth, the ocelli black; the head is covered with minute black points and some longer pale hairs. The anterior legs are yellowish-green, the ventral and anal prolegs are the same colour as the belly but semi-transparent.

The skin of this larva is really shining, as it affords a line of bright light along the body according to the position in which it is viewed, but the numerous points and soft hairs produce the velvety look. The dorsal line is just slightly paler than the ground colour, a very slender thread showing faintly over a rather broader and pulsating one beneath.

The black points, it may be noted, are of two sizes; the smaller and more numerous are only to be seen with a powerful lens.

On the 4th and 5th July these larvæ attached themselves and assumed the pupa state on the 6th and 7th. The perfect insects made their appearance on the 15th and 17th of July, 1874. (W. B., Note-Book II, 79.)

#### PIERIS DAPLIDICE.

#### Plate III, fig. 1.

On the 18th August, 1882, I received from Herr Heinrich Disqué, of Speyer, thirty-three eggs of this species (along with the dead parent butterfly) laid on the flowers, leaves, and stems of a species of *Reseda*.

The egg is laid standing on end and is about the same size and red colour as an anther of the flower of the plant on which it is laid, but can be detected by

tion, and from being interrupted at each segmental division ; it passed over each ventral leg. The spiracles were flesh colour, with paler whitish centre, very inconspicuous and situated on the yellow stripe upon the second subdivisional ring of each segment. The belly along the middle was glaucous and paler than the green beneath the spiracular stripe.

These larvæ were fond of lying at full length along the flower spikes, and several crowded together at the summit in amicable companionship ; often they would have the head downward, sometimes with the anterior segments hanging free. Their movements when feeding were slow and very graceful, as their flexible bodies accommodated themselves readily to any inequality of surface over which they glided ; they covered the stems and other parts with fine silk threads, which proceeding rendered their footing more secure. They seemed quite as partial to the flowers as to the leaves and thus varied their food.

On the 28th of September one pupated on the leno-cover of a cylinder and another a day or two later. From that period, owing to the setting in of colder weather, the remaining larvæ became torpid and seemed unable to move, and though a few fed a little occasionally and spun themselves up, yet they only became abortive pupæ, dying in one or two instances after the larval skin had burst, and whilst the ridge of the pupal thorax was developing ; others dropped off the stems unable to retain their hold, whilst a few remained on the stems in their natural positions for some days after they were dead.

It was evidently proved by this experiment that *Daplidice* is quite unsuited to our climate, and is an insect belonging to a warmer country.

The pupa measures  $7\frac{1}{4}$  lines in length, being thickest across the thorax and near the end of the wing covers ; the head bears a projecting taper-point in front ; the thorax is sharply keeled and humped on the back.

When first disclosed the colour of the pupa is almost

the same as that of the larva, darkish grey spotted with black, and showing subdorsal and spiracular yellowish lines ; the sharply humped keel of the thorax is traversed by a pale yellow dorsal line ; the cincture appears quite sunk into the substance of the back and is only visible over the wing-covers. These last are greyish, having two darker dusky streaks parallel to the hind margin.

After some days the grey colouring faded to whitish with numerous black dots. By the middle of November one of the two pupæ had turned black and was dead ; the middle of the abdomen had collapsed, but the other pupa lived and produced a male butterfly on the 14th of June, 1883. (W. B., Note-Book IV, 165.)

#### LEUCOPHASIA SINAPIS.

##### Plate III, fig. 3.

For eggs of this species I am indebted to the kindness of Mr. C. G. Barrett, and it has been with no ordinary pleasure that I have watched its transformations ; for the insect has always been a favourite of mine ever since I began collecting—now some ten years ago.

The eggs seem to be deposited singly ; in shape they are cylindrical, very long, standing erect on end, the upper end coming to a point, which is curved a little to one side (reminding one somewhat of the shape of a cucumber), ribbed longitudinally—about four ribs appearing in any one view ; colour a glistening yellowish-white.

The larva when full grown is about three quarters of an inch in length ; head globular, rather smaller than the second segment ; body cylindrical, tolerably uniform in bulk, but tapering very gently towards the tail ; anal flap terminating squarely, and under it two very small blunt points appear ; the skin

wrinkled, with six folds to each segment, covered uniformly, but not densely, with very fine short whitish down.

Colour a beautiful green, the front segments minutely dotted with black; dorsal line darker green, edged with yellowish-green; spiracular line distinct, of a fine clear yellow, edged above with darker green; spiracles indistinguishable; belly and legs translucent green.

When the larva is about to spin, it fastens itself, with the head upwards, to a stem of its food-plant by a little webbing at the head and at the tail, and with a thread round the fore part of the body. At first it rests quite flat on the stem, but after some hours it raises its back, and bends itself into a bow, the head and tail still fastened to the stem, and the thread round the body being much stretched; in this position it remains about two days, then it casts its skin for the last time (the threads which fasten down the head apparently being attached only to the larva skin), and becomes a pupa. The pupa when arrived at its full colour is very beautiful. In shape it is slender, very acutely pointed at the head, not so acutely at the tail; the wing-cases projecting in a swelling curve to nearly twice the width of the body, and meeting in a blunt ridge; the head is thrown back, and the pupa rests with the wing-cases touching the stem, fastened by the tail and by the thread round the body.

The skin is semi-transparent, the colour a lovely delicate green; the abdomen rather yellowish; just in the spiracular region there runs all round the body a stout pink rib, enclosing the greenish spiracles; from this a strong pink line branches off, bordering the outer edge of each wing-case, and the nervures of the wings themselves are delicately outlined in pink.

I received some eggs on August 2nd, and again on September 1st, 1866; the larvæ appeared on August 8th and September 6th respectively; full fed on September 26th and November 8th; in pupa September 29th and November 9th. The food chosen was either

*Vicia cracca* or *Orobus tuberosus*, but not both. (J. H., E.M.M. III, 210.) The imago emerged on the 9th of May, 1867.

### LASIOMMATA ÆGERIA.

#### Plate IV, fig. 1.

On the 23rd of April, 1873, I received from the Rev. John Hellins, of Exeter, three larvæ that he had brought through hibernation, having reared them from eggs. They were exactly seven-eighths of an inch long and slender, thickest in the middle, the head rounded; in colour a very bright green slightly inclining to olive, the dorsal stripe darker green, attenuated at each end, and having a faint paler central line within it, and margined by a line of greenish-yellow.

They were feeding on cock's-foot grass (*Dactylis glomerata*). By the 28th they were an inch long, though one of them was barely that length. On the 2nd of May one had become almost without lines, and paler; May 6th one assumed the pupa state, but one was still feeding on the 9th of May.

The subdorsal lines are of the same greenish-yellow, margined above by a fine line of darker green than the ground colour; a little below run three parallel undulating fine lines of faint greenish-yellow; the spiracles, which are flesh-coloured, being placed on the lowest of these lines; the space between the two lowermost is the widest enclosing a faint interrupted fine line, a little paler than the ground colour.

The whole surface is very finely pubescent, giving a soft velvet-like appearance; seen through a lens the fine tubercular hairs appear black, the rest greenish.

Each segment is subdivided by transverse wrinkles into six portions, viz. five of equal width behind and a broader one in front; on the thirteenth segment are two blunt whitish or flesh-coloured anal points.

The pupa is half an inch long, very plump, and of pale yellowish green; on the subdorsal lines, which are slightly raised, there are raised dots, two of which are pale yellow on each side of the broadest part of the back of the abdomen; the surface is smooth, but without gloss; the abdominal segments are scarcely indicated by any divisions.

The butterfly came forth June 4th, 1873. (W. B., Note Book II, 1.)

#### HIPPARCHIA SEMELE.

##### Plate IV, fig. 3.

Eggs of this species were obtained by Dr. Knaggs in 1864, and were sent to the Rev. J. Hellins July 26th and August 3rd; some of them hatched August 8th, and others continuously for three or four days.

The larvæ were at first ochreous, with a blackish interrupted dorsal line; they fed on *Triticum repens*, were very sluggish, often hiding low down amongst the grass, and hybernated when about four lines in length. One larva only survived the winter, and this was kindly presented to me on the 13th of May, 1865, by Mr. Hellins, to whom I am indebted for the foregoing account of it.

The larva had shown a partiality for *Aira cæspitosa* previous to my receiving it, it was therefore placed on this grass, being then about eight lines in length.

On the 20th of May I chanced to dig up a rather larger larva of this species from a waste piece of sandy ground near the sea, amongst *Aira præcox* and other small grasses, which rendered the task of rearing doubly interesting, in observing the habits of each, kept separate and on different foods.

The captured larva on being placed under a glass in a pot with its native growing food immediately burrowed in the sandy earth, and the few times it was

seen on the grass were always at night, and each morning brought evidence of its doing well by the diminished grass.

About the 14th of June these indications ceased, and on the 23rd I searched for the pupa, and found it in a hollow space a quarter of an inch below the surface, the particles of sand and earth very slightly cohering together, and close to the roots of the grass, yet free from them. The pupa was obtuse, rounded, tumid and smooth, the abdominal rings scarcely visible, and wholly of a deep red mahogany colour. The perfect insect (a ♂) appeared July 24th.

The larva, reared wholly in captivity from the egg, always remained on its rigid food, with its head uppermost when feeding, which at first it did both day and night till it was an inch long, from which time it fed only at night, remaining all day at rest on the grass, with its head downwards, in comparative darkness, amongst the lower parts of the stems. It never showed any disposition to burrow, though the soil was supplied for the purpose, until it was full fed about the middle of June. The butterfly (a ♂) appeared August 5th.

No material difference existed between the two larvæ, excepting that the captured one was rather less bright and distinct in colour and markings than the other.

The full grown larva is an inch and a half in length, tapering much to the anal forked extremity, and a little towards the head, which is globular. The ground colour of the back is a delicately mottled drab, with longitudinal stripes broadest along the middle segments, viz. a dorsal stripe of olive-brown, very dark at the beginning of each segment, with a thin edging of brownish-white. Along the subdorsal region are three stripes, of which the first is composed of a double narrow line of yellowish-brown, the second wider of the mottled ground colour, edged with paler above and with white below, the third of similar width is of a dark grey-brown, edged above with black. The spiracular stripe is broader and of nearly equal width,

pale ochreous-brown, edged with brownish-white both above and below; the spiracles black. Belly and legs drab colour. The head brown, on it the principal stripes of the body are delicately marked with darker brown. (W. B., E.M.M. II, 188.)

### EREBIA BLANDINA (*MEDEA*).

#### Plate VI, fig. 1.

That I am able to offer a complete history of the transformations of this species is another example of the proverb, "Union is strength."

For not to one only, but to several of my friends am I indebted for help. To Dr. White and Mr. Longstaff for the eggs, plentifully supplied to myself and Mr. Hellins; to Mrs. Hutchinson and to Miss Pasley for sending me the surviving larvæ reared by them over the winter, when I had myself entirely lost all my stock. As far as I can ascertain, only four larvæ came to maturity out of the two hundred hatched last year, the vast majority dying in hibernation and at the first spring moult; it can well be understood, therefore, how dear the satisfaction was, won after such loss, of securing this species.

The eggs were sent to us at the end of August, 1869; the larvæ hatched during the first week of September; fed and grew slowly till the winter; hibernated when between two and three lines in length; resumed feeding in March or April, and attained full growth between the end of May and the middle of July. The food was for the most part *Aira precox*, but Mr. Hellins found that *A. cæspitosa* was eaten as the larva approached maturity. One imago emerged on July 15th.

The egg may be called large for the size of the insect and is nearly globular, though somewhat ovate, in shape, and placed on end; the shell is glistening, and

ribbed, but not deeply, with about thirty longitudina ribs, and with very shallow transverse reticulations ; the colour is pale greenish-yellow, afterwards pale pinkish-grey, speckled with claret-brown.

The larva when small has the head large and rounded, is stout forwards, and tapers from the middle to the tail ; it is greyish with reddish-brown dorsal, subdorsal, lateral, and spiracular lines, the lateral lines being broader than the rest ; the spiracles black, with another brown line below them ; the skin covered, though not very closely, with short, stout, curved pellucid bristles.

It hibernates when rather over the length of two lines ; creeping down the blades of grass, and hiding in the thickest parts of the tufts. Soon after commencing to eat again in spring, the larva assumes somewhat of a greenish tint, but after a moult the grey colour returns.

In May one was described which had then assumed the last dress. It was three-quarters of an inch in length, stout in proportion, thickest at about the fourth segment, the back tapering somewhat in a curve, the belly flattened, with the prolegs placed well under it ; the head globular, scarcely narrower than the second segment ; the anal segment bearing two not very prominent blunt points ; each segment bearing on the back five transverse ridges studded with minute raised warts, emitting fine short tapering bristles ; the head was also covered with still more minute bristle-bearing warts.

The ground colour is pale drab, the warts being pale whitish-brown ; the dorsal stripe is blackish-brown, most intense on the hinder segments, and enclosed by two lines of a paler drab than the ground colour ; there is a broad subdorsal stripe of paler drab, growing narrower as it approaches the anal point, edged above with a greenish-brown thread, and below with blackish or brownish dashes, that almost form a continuous line, the interruptions occurring at the beginning of each segment ; below this come two thin pale lines,

above the lower of which are situated the circular black spiracles, each in a little puffed eminence; this lower line in fact forms a ridge, edged below with an interrupted brown line; the belly and legs are of a somewhat warmer tint of the ground colour of the back.

The larva thus described continued to grow till June 4th, when it was seven-eighths of an inch long, and stout in proportion, with its back deeper in colour than the sides; and presently after this its colouring grew paler with a pinkish suffusion spread over it, and by June 22nd it had changed to a pupa, unattached, but placed in an upright position amongst the grass near the ground.

Throughout its whole larval life this species is very quiet and even sluggish.

The pupa is nearly five-eighths of an inch in length, the wing-cases long, the abdomen plump, thickest in the middle, tapering to the tail, and ending in a blunt flat spike; the back of the thorax is rounded, the head and the eye-pieces prominent.

At first the head, thorax, and wing-covers were semi-transparent, and of a pinkish-grey tint, the abdomen ochreous, with dark dorsal stripe and other lines, and spiracles also as in the larva; but by July 10th the eyes became black; the thorax, antenna-cases, and wing-covers, after passing through an opaque cream-coloured stage, finally changed to a dingy dark pinkish-brown.

The butterfly, a very fine male, came forth on July 15th; but at the present date (July 19th, 1870) Mr. Hellins has a larva only just beginning to change. (W. B., 19, 7, 70; E.M.M. VII, 64.)

EREbia CASSIOPE (*EPIPHRON*).

## Plate VI, fig. 2.

On Wednesday July 1st, 1874, I received from Mr. John Archer, of Workington, six specimens of this butterfly, which he had captured on the 29th of June, on the top of Green Gable Mountain at the head of Buttermere, about twenty-five miles from Workington. There the soil is peat moss, and very boggy. Some roots of *Nardus stricta* also came at the same time, with a pale kind of moss, amongst which, intermixed, the grass was growing.

Soon after the insects arrived four of them revived when placed in the sun, and three hours later a fifth recovered—so that one only had died during the journey.

I had the grass at once potted in peat and leaf-mould, and placed the insects on it, covering them with some silk net (rather coarse-meshed) to prevent their escape, and I put them out of doors in the sun. They were supplied with a bit of sponge dipped in sugar and water, and seemed very lively, fluttering about. On the morning of Thursday, July 2nd, they were placed at an open sunny window, and at noon I observed that one egg had been laid on the net, extruded through and adhering to the outside; at one o'clock six eggs had been laid in a similar manner, and by three o'clock in the afternoon there were in all fifteen eggs laid, only one of them being on the grass.

The next day proved dull, windy, and sunless, and no more eggs were laid and three only of the insects were alive. On the morning of the 4th July all were dead, and on again counting the eggs I found there were fifteen on the net and one on the grass, making a total of sixteen.

The egg of *Erebia Cassiope* is rather large for the size of the insect, elliptical in figure though rounded

at the top, rather larger towards the base, which is also rounded off and a little depressed in the centre; it is ribbed. All were laid in a vertical position adhering by the biggest end. When first laid and for a day after it is a bright canary yellow, and in two days it changes to a slight tint of pale olive-greenish, but it is still very shining.

On the fourth day (July 5th) the eggs were spotted over with a faint brown at regular intervals, the next day they were of a pale brownish tint, spotted with deeper brown. By the 13th they had become of a pinkish drab colour, with the upper end or top of the egg darker than the rest. On the 14th their colour had assumed a dirty tinge and their hatching seemed imminent, and by the evening I found that three young larvæ were already disclosed, and other five were hatched by the following morning.

The newly hatched larvæ were flesh-coloured, with ochreous flesh-coloured heads, a faint purplish-grey tinge showing through the skin of their bodies. The larvæ ate away the tops of their egg-shells, indeed two or three of them ate about two-thirds of the egg-shells, which were quite white and very clear and thin.

The young larvæ were at first offered *Festuca ovina*, *Aira flexuosa*, and *Poa annua*; this last bore slight evidence of having been a little eaten, though they were generally to be seen on the *Aira flexuosa*. On the second day one was found to be dead.

Shortly afterwards I put them on some *Nardus stricta* covered with grenadine, but they all escaped through the meshes, having a fancy to feed on the summits of the grass leaves, which protruded through the grenadine. (W. B., Note Book II, 80.)

The pupa of *Cassiope* is little more than three-eighths of an inch in length, rather thick in proportion, being less dumpy in form than *Hyperanthus*, but more so than *Blandina*. The colour of the back of the thorax and wing-cases is a light green, rather glaucous; the abdomen a pale drab or dirty whitish; a dark brown

dorsal streak is conspicuous on the thorax, and there is the faintest possible indication of its being continued as a stripe along the abdomen. The eye-, trunk-, antenna- and leg-cases are margined with dark brown, and the wing nervures are indicated by the same colour. The surface is only slightly glistening. (W. B., MS. 2, 6, 75.)

### CœNONYMPHA DAVUS.

#### Plate VI, fig. 3.

On the 22nd of August, 1864, Mr. Newman kindly sent me two young larvæ of this species, which had been bred from eggs obtained by Mr. Samuel Hudson,\* of Epworth, to whom I have been very greatly indebted for information concerning them, and their locality, and also for a plentiful supply of roots of their food-plant, *Rhynchospora alba* (the beaked rush), which kept alive through the winter, though the young larvæ did not survive. But again I was indebted to Mr. Hudson, who sought for the larvæ on the moors in the early spring and replaced my loss, having found several larvæ feeding, one of which he once observed to eat a little of *Eriophorum* (cotton-grass); but the beaked rush is evidently its proper food, from the fact of both larva and imago being always in the low-lying boggy parts, where the beaked rush most abounds; whereas in the higher commons, which are covered with cotton grass, neither the larva nor the butterfly has been seen.

The habits of the larvæ differ much from those of the allied genera in being particularly active and lively, travelling much over their food-plant, an allwise provision, enabling them to escape the inundations to which they are liable. The larva does not change much after the second moult, and when full grown,

\* Mr. Hudson described them as far as the second moult in the 'Zoologist' for 1864, p. 9252.

attains to an inch in length, the head being globular, and body tapering towards the anal forked extremity.

It is of a bright green with dark bluish-green dorsal line, edged with pale lemon yellow, the sub-dorsal and spiracular lines are of the same pale yellow, but the sub-dorsal is edged above with dark bluish-green, and between those two lines is an interrupted streak of a darker colour, posteriorly with a slight tinge of reddish or pink, and the caudal fork is tipped with pink.

On the 2nd of June a larva was attached to a rush near the top, and changed to a bright green pupa, which in a few days showed brown streaks on the edges and centre of the wing-covers and at the tip of the tail, so remaining until the morning of June 20th, when it was wholly dark brown; and at noon the imago came forth, a fine dark specimen. (W. B., 21, 6, 65; E.M.M. II, 65.)

Of the variety of *C. Davus*, known as *Typhon*, I received two eggs from Dr. F. Buchanan White August 18th, 1871, which hatched on the 23rd and 25th. These eggs were large and rather ovate-spherical, very finely reticulated, their colour pale straw, very faintly blotched with whity-brown.

The young larva is of a whity-brown tint, with bifurcate tail, and having the lines of the ordinary larva of *Davus* very faintly marked; it is rather large when hatched and big-headed and less sluggish in its movements than the habit of *Davus* when more mature. (W. B., Note Book I, 130.)

#### LIMENITIS SIBYLLA.

#### Plate VII, fig. 1.

I am very much indebted to the kindness of Mr. Barrett, who most obligingly sent me on May 14th, 1867, several examples of the larva of this species, varying from half an inch to their full growth of one inch and a quarter in length.

At first they ate the young and tender shoots of honeysuckle (*Lonicera periclymenum*), and then the lower leaves, reascending to the top of the bare stem to undergo the process of moulting, with the exception of one small larva, that spun the edges of a leaf together and moulted within it; they then ate their way downwards as before, and kept on the sunny side of their food. They appeared to spin much silk along the stems during their career, and to partly secure the leaves by it in a suitable position to steady them during their repast, and, in consequence, their long spines in front became, in some of them, clogged and entangled or tied together by the silk in their twining progress among the leaves, though they appeared never wholly to trust themselves from the stem, as their anal prolegs at least were always attached to it. As they reposed along the spiral stem or bent aside to feed they were very elegant creatures, assuming the most graceful positions. They seemed to like the sunshine, and when exposed to it, appeared to be active and hungry.

In structure the body is of nearly equal width, the second and anal segments being the smallest, the divisions and transverse wrinkles well-defined, the whole upper surface covered with transverse rows of minute raised points, and on the third, fourth, and sixth segments, a pair of long, tapering, branched, subdorsal spines; similar pairs, but rather shorter, are on the eleventh and twelfth, while on each of the other segments, except the second, are a pair of very short similar spines, and two minute pairs of them on the thirteenth; a row of exceedingly small spines are visible above the spiracles. The spiracular region is distended, forming a projecting ridge below, armed with very short branched spines, a row of short simple spines above the feet, and a ring of them round each proleg, and on the ventral surface of each segment a central transverse row of them. The head has the crown elevated, and face slightly convex, the whole surface covered with

raised points and simple obtuse spines, with a longer and sharper pair on the crown.

In colour the back is of a bright full green, blending gradually into a paler tint at the sides, the minute raised points yellowish; a white spiracular stripe is conspicuous from the sixth to the anal segments, with a central yellow blotch on each segment; the edging of branched spines white, beautifully relieved by a crimson or red-brown stripe beneath, beginning on the sixth, or generally the seventh, and ending on the tenth segment.

The ventral surface is bluish-green at the divisions, and grass-green across the centre of each segment, and whitish-green on the two or three last segments; the prolegs are tipped with pinkish.

The head is pale pinkish or greenish, with a crimson or brown stripe on each side of the face; the mouth pink, with the mandibles black; the whole face is thickly studded with yellowish obtuse spines, with a few black ones, the longest pair on the crown black.

The subdorsal spines are reddish, crimson at the tips, where they are branched with black, and below they are yellowish.

When full-fed the larva becomes rapidly paler, and then suspends itself by the anal prolegs to a stem\* of the honeysuckle or other surface, and hangs with its body downwards in a sinuous curve, with its head bent a little upwards facing the abdomen; it then remains motionless for three days, becoming whitish on the abdomen and remaining very pale green on the thoracic segments.

In the course of the third day the creature seems to wake up, unbends its head, swings itself to and fro a

\* In order to ascertain the natural habitat of the pupa of this species Mr. C. G. Barrett visited Woolmer Forest on the 14th of June, 1867, and in the course of several hours' search found four pupæ and two suspended larvæ of *Limenitis Sibylla*. Of these, five were spun up to leaves of honeysuckle, and one to a leaf of *Rhamnus frangula* growing contiguously, and in every case were firmly suspended to a button of silk on the underside of the midrib of the leaf. Not a single specimen was found attached to a stem or branch.—H. T. S. [E.M.M. iv, 35.]

few times, then stretches itself downwards in a long attenuated line, which causes a rupture of the skin close to the head ; the skin then is seen slowly to ascend, exposing the bare and soft shining parts below, from which a flat and forked pair of horns grow out perceptibly as one beholds this wonderful process ; the skin continues to glide slowly upwards, and as the soft parts become exposed they are seen to swell out laterally and to assume the very singular projections so characteristic of this chrysalis, the skin of the old head gliding up the belly marks the progress of the disclosure as the colour of the old and new surfaces is at this time alike, the new being, however, rather more shining and transparent.

Occasionally during the bulging out of the soft parts, a kind of convulsive heave or two occurs, but otherwise it remains still until the creature is uncovered as far as the ninth or tenth segment, it then curves its anal extremity by a sudden twist laterally, and in a moment dexterously withdraws the tip of the anal segment from the larval prolegs by an opening on the back of the skin at that part. At this critical moment one has time to see that the naked shining point is furnished with black hooks, and to apprehend a fall, but in another moment the pupa has forcibly pressed the curved tip with its hooks against the stem close to the previous attachment of the anal prolegs, and now it is strongly and securely fixed.

The creature now seems endowed with wonderful power and vigour, it swings boldly to and fro, and undulates itself as if to gain longer swings, when presently the old skin that remains is seen to burst away and fall off, the chrysalis gradually becoming quiescent.

The entire metamorphosis from the first waking to the last movement, occupied nearly seven minutes. In sixteen days the perfect insect emerged.

The chrysalis is very angular, and its wing-cases very projecting, the dorsal surface of the thorax rises to a prominent ridge, and a little beyond it is a flat,

round, and very projecting process on the back, and from thence to the anal tip the abdomen is slightly sinuous, and therefore hangs a little on one side ; two flat-forked processes project from the head. Its colour at first is a greenish-white, but it gradually darkens, and in a few days the thorax and wing-cases are deep olive-green, the centre of the back of the abdomen bright apple-green, its tip and underside being dark brown, which forms on the back a broad band, including the flat circular prominence at its termination. The hare's-ear-like projections at the head are also dark brown, the nervures of the wings can be seen distinctly ; the portions that at first appeared quite white have now been transmuted into metallic adornments ; a brilliant golden streak divides the brown colour from the green of the wings, commencing on each side of the back of the thorax, and a golden spot is seen on each side the tip of the tail; three silvery spots decorate the underside of the abdomen, and the head and its prominences are embellished both above and beneath with similar spots and streaks. (W. B., 6, 67; E.M.M. IV, 33.)

Some years ago *Limenitis Sibylla* was plentiful enough in the woods in this vicinity, and thinking I could at any time study its history, I postponed any attempt to obtain its egg or larva until I should have worked out other species sent to me from a distance and which I could not hope to have always at hand.

But since that horribly cold and wet season of 1860-61, I have never seen a single specimen ; and apparently, as far as this locality is concerned, *Sibylla* (and I may add *Apatura Iris* also) was then exterminated.

However, through the kindness of Mr. C. G. Barrett, and his indefatigable exertions whilst at Haslemere, I have been able to study and figure the larva, my notes on its appearance when full grown, as well as in the pupa [being those given above], having been already published (E.M.M. IV, 33), and I would now offer some account of it at an earlier stage, not as being

able to disclose something entirely new, but as describing exactly what I have seen.

The hybernaculum which Mr. Barrett sent me was placed as he describes it, “*three or four buds down*” from the tip of a twig shooting out from the main stalks of a great honeysuckle-bine which climbed up a fir-tree; the twig chosen for this purpose sloped a little upwards, but he could not discover any hybernaculum that could fairly be called pendulous.

The one I have before me is made of a honeysuckle leaf, which had been first partly bitten through near its axil, and then securely fixed by its two edges for about half its length to the twig from which it grew, and across which its edges were firmly bound with a spinning of strong silk; the remainder of the leaf curved off from the twig at an angle of about 40°, being divided along the mid-rib for about one-tenth of an inch from the tip—thus forming two little hare’s-ears as it were—and from them up to the twig, having its two edges firmly spun together. Just at the point where this half of the leaf meets the underside of the twig there is a circular aperture, apparently designed by the larva for its egress in the spring.

As the leaf withers, the hybernaculum assumes a puckered fusiform shape, scarcely more than half an inch in length, being convex on the upper outline, and scarcely concave below, with the middle irregularly swollen, and the little hare’s-ears hanging apart; but I am sure, from the firmness with which the whole structure is fixed to the twig, it could not have swung with an independent motion of its own. Its natural appearance of a small shrivelled leaf clinging to the dry stem would readily escape ordinary observation.

On waking in April, sooner or later, according to the season, the little occupant leaves its abode, but goes no farther than to the upper side of the twig immediately above the aperture it has quitted, and at this time is about three lines long, spiny, and is wholly of a reddish-brown colour.

Its first proceeding is now to cast off its winter coat, and accordingly it attaches itself to a spinning of silk on the twig, and by degrees crawls out of its old skin, which is left adhering to the silk, not shrivelled up, but looking still much like a larva.

It is now a much fresher looking creature, and after feeding on the just bursting buds of its twig, it is by the beginning of May half an inch long, brown on the back, with spines of the same colour, and yellowish-white along the sides, on which the blackish spiracles appear very distinct. Just above the ventral legs it shows a reddish-brown stripe; the legs and belly are rather paler brown. In a few days it again moults, and then assumes a miniature resemblance of the adult larva already described. (W. B., 1, 69; E.M.M. V, 226.)

#### APATURA IRIS.

#### Plate VII, fig. 2.

It is quite as difficult to convey to others a due sense of my gratification in having been able to observe the wonderful larva of this imperial species, as it is to express adequately my grateful thanks to my kind friend Mr. Doubleday, for the two fine examples of it sent me on the June 5th, 1867, feeding on sallow—*Salix caprea*.

This larva is not slow in its movements, which are very graceful as it turns and accommodates itself to the various positions necessary to its progress amongst the leaves, eating rapidly and voraciously, cutting out a large portion of a leaf in a few seconds; but it is easily alarmed, for a touch of the leaf or slight shake of the spray transforms it into a very different looking creature.

Its structure cannot be well understood until it is seen walking or feeding; then the flexible motions of the head become apparent, furnished as it is on the

crown with a pair of long forked, tapering horns, blunt at their tips, curved on their inner sides and concavely bent a little in front, and covered with raised points on their front surfaces. They are much like those of a snail, but not retractile or moveable, though when the head is rapidly in action, as is the case in feeding, the horns are displayed perpendicularly, or sloping backwards and forwards; but they are horizontal when the larva is at rest or in alarm. The crown is slightly notched and the face rather flattened above, but a little convex towards the lower part where it is widest.

When full grown and stretched out the larva attains the length of two inches, is rounded, and tapering towards both head and tail, the anal segment terminating in an elongated, rather flattened point, which is, however, divided and slightly forked at its extremity; the prolegs short and thick, with a fringe of short hairs above them along the sides; the segments are subdivided into five portions, the anterior being much the widest, and all are studded with rows of minute raised points.

When the larva is alarmed the segmental divisions and deep subdivisions disappear as it suddenly contracts its length, and are all drawn up so closely together as to make the raised points resemble the pile of a rich velvet; at such times, and when at rest, the head is bent down, the horns appear in a line with the body, the back much arched, thickened, and rounded, remaining a long time motionless, assimilating admirably with the leaf on which it rests. It reposes on a leaf, generally on the under side, but not invariably so, and spins a quantity of silk, to which it firmly adheres.

In colour the larva is a bright full green on the back and sides, as far as the sixth segment, then blending gradually into a yellower green, with the three last segments much paler; the whole surface is studded with minute yellow points.

On the back of each horn, and extending along the second, third, and fourth segment, is a subdorsal stripe

of pinkish or yellowish flesh-colour ; and on each side of the other segments, as far as the tenth inclusive, a thin oblique stripe of dull yellow, slightly edged with red, running backwards from the spiracular region of one segment to the subdorsal region of the next ; the most conspicuous is that which begins on the sixth and ends on the back of the eighth segment, being longer and thicker, especially at the end, which is bordered above by a purplish-brown or crimson mark ; the raised points there being much longer and larger than those on the other lines, as they also are longer than those of the green surface. There is a pale yellowish lateral stripe on the anal segment, extending to the tips. The spiracles are red, and below them the green softens into a pale whitish-green, with a fringe of white silky hairs above the prolegs ; these last are of a pale transparent bluish-green, the ventral surface whitish.

The head behind is the same colour as the back, and the face a pale, shining, whitish-green ; the horns in front bluish-green, which colour extends as a stripe down each side of the face ; the tips of the horns brownish-red, and a little below they have a few raised black dots.

When full-fed the larva spins a large quantity of silk on the under side of the leaf, to which it attaches itself by the anal prolegs, and slightly with the anterior pair of ventral ones, and remains motionless for about four days ; it then relaxes its hold by the ventral prolegs and hangs down, suspended only by the anal pair, and within an hour the transformation to a pupa is complete.

The form of the pupa is broad and flattened on the sides, the outline of the abdomen and wing-cases nearly straight, while that of the back forms a very obtuse angle, having a thin and rather sharp ridge, projecting to a point about midway, from which it slopes off to the anal point and to the head, which has a short, pointed, and flattened forked pair of appendages. Seen only from the back or front it would appear a rather long and slender pupa in comparison with a side view.

Its colour is a very pale whitish-green, with whitish oblique lines on the sides, also nervures on the wing-cases and dorsal ridge. In three weeks the perfect insect was disclosed. (W. B., 8, 67; E.M.M., IV, 85.)

Since the foregoing account of the full-grown larva of *Apatura Iris* was written, I have had opportunities of observing its development *ab ovo*.

For the eggs, I have been indebted to the kindness of Mr. W. H. Harwood, of Colchester, and Mr. E. F. Bisshopp, of Ipswich, viz. a single egg from the former, received the 31st of July, 1875, laid within the three or four previous days on the upper side of a leaf of *Salix capraea*; and from the last named on the 1st of August, 1875, four eggs laid July 29th on pieces of paper.

The egg, as may be supposed, is of a good size, its shape cylindrical, of about equal height and diameter, adhesively fixed in an upright position on its flat base, domed on the top, its surface strongly ribbed, the ribs varying in number from twelve to fourteen. All the eggs were alike in colour when I first received them, viz. of a yellowish olive-green, having near the base a zone of purplish-black, the green portion semi-transparent, the surface glistening. Those laid on the paper began to change on the 4th of August, by displacement of the black zone and the appearance of a blackish spot within the centre; on the 5th the whole top grew at first cloudy, then blackish, the lower part paler green than before; this on the 6th became still paler, and the ribs whitish, and on that day, about seven o'clock in the evening, three eggs hatched, and the fourth at ten o'clock. The egg from Colchester hatched three days later, after previously passing through similar changes.

When just hatched the larva has a large rounded head, and two distinctly separated anal points; its colour is a light dirty greenish yellow, with three faintly darker lines down the back, the head is of a dark chocolate brown.

The day after hatching each larva was resting on

the tip of a leaf ; each leaf thus tenanted showed that, at a little distance below the larva, a small portion had been eaten from its edge, on one side, *quite through the whole substance*. The larvæ were now just one-eighth of an inch long, and on their rough granulous heads, could be seen, with the aid of a lens, two large, somewhat bright, oval, smooth patches of paler colour, each with a central dark spot occupying the crown of the lobes ; the body light yellowish-green, faintly showing a darker dorsal line and slanting side streaks.

When but five days old I found the Colchester larva lying dead, where it had been feeding on the edge of a leaf ; the cause of this mishap arose from the state of its food, which could not without risk be changed the day before, as three of the other larvæ just a week old were fixed for moulting, each on a coating of silk, spun either on the glass cylinder or on the side or tip of a sallow leaf ; the other larva, not previously visible for a day or two, now made its appearance again, having already completed its first moult, furnished with remarkably long and stout horns, cleft at the dark reddish tips. This I noted as No. 1, a very lively and active little creature, roaming over the sallow leaves for an hour or two after its removal from the rest before establishing its footing on a leaf point.

On the tenth day No. 2, which had been fixed on the cylinder, moulted ; on the twelfth day No. 3, on a leaf tip, had also moulted, both furnished with horns like No. 1. The remaining larva moulted on the thirteenth day, but appeared without horns, the head being much the same as before, though the colouring of the body was changed like the others, viz. to a bright green, with yellowish subdorsal stripes on the six anterior segments, and yellow slanting lines along the sides of the others, the points of the tail brought close together appearing very like one anal point, ringed with red. This hornless larva fed and seemed very lively and well up to the twenty-first day, when it spun a layer of silk

on a leaf, on which it remained quietly for a couple of days, then at intervals struggling and contorting itself during two more; however, in the course of the following day it died with its front segments rigidly curved backwards.

From the end of August my attention was devoted to the three survivors, of which No. 1 had moulted a second time on the 21st of August, a third time on the 28th, and a fourth time on the 5th of September, when it was a little over one inch in length; on the 11th it fixed itself for its fifth moult on silk spun upon the glass cylinder, and measured then one inch and three-eighths in length; by the 21st it had attained its greatest length of two inches, and was stout in proportion.

From this date, although continuing to feed well, it appeared to be getting shorter by slow degrees, and the few scattered purplish-black points as usual appeared, and by the 25th had greatly increased, forming dark blotches on the back of the tenth, eleventh, and twelfth segments, the general green ground colour becoming paler. In the afternoon of this day it left its favourite silk-carpeted leaf, where latterly it always returned to rest after every meal made on other leaves, and took up a position on a stem, head downwards, the head and front segments hanging free, but in half an hour it removed to another stem, where in a similar posture it remained for about the same space of time. But here, as previously, it seemed incommoded by too close proximity with other stems and leaves, for it again moved off and ascended to one of the upper leaves and crept beneath it, and there, after resting a few minutes, it began to spin a coating of silk, leisurely adding to it at intervals during the evening, and probably during the night, as I noticed next morning some stout threads had been spun from the foot-stalk of the leaf to the main stem, firmly securing the position of one to the other. The larva now remained quite still, its head and horns in line with the body towards the stem, and its

tail a little way from the tip of the leaf, the back much arched, the anal pair of legs securely fixed in a pad of silk, and the first ventral pair clinging to the silken carpet, which they dragged off a little from the leaf at the point of contact. The assimilation in colour to the under-side of a sallow leaf was very perfect.

Larva No. 2 completed its third moult on the 5th of September, and was then seven-eighths of an inch long. After this it was kept apart, feeding well, and attaining the length of about two inches by the 25th of the month, and on the 28th it had spun its carpet under a leaf, and secured itself similarly to the preceding.

Larva No. 3 moulted a second time on the 3rd of September, when its length was just half an inch; from this time it fed very sparingly, often changing its position as its food was changed, until the 25th of the month, when I found it was hibernating on the stem of a twig, the hinder half of its body enveloped in a mass of silk where it remained immoveable; only by very gently touching its horns occasionally as winter advanced could I be sure it was alive.

Beyond keeping them in a room, of which the window was closed only at night, I was unconscious of anything I had done to stimulate premature development of the two larvæ which so rapidly attained full growth; certainly I attended to them carefully, and watched them with much interest, especially while feeding, an operation I noticed performed oftener by night than by day.

After moulting the green colour of the larva was at first very pale, like the under-side of a sallow leaf, for a day or two, for which period it would remain on the underside of a leaf, until its green colour had become brighter and darker, when it would again rest on the upper surface of the leaf. After the last moult, and sometimes before, each larva had a special leaf spun over the upper surface with silk, on which it rested in such a position that its head was facing the foot-stalk, and bent down so as almost to touch the

leaf, the anterior legs drawn in close to the body ; sometimes all the ventral legs, and sometimes only the third and fourth pair in addition to the anal pair, had a footing on the silk. When hungry, the larva would quit this, make a rapid meal, and return again to rest. Some leaves were so ravaged that only the mid-ribs were left. Once I was rather surprised to see the larva No. 2 eat off a large strip from one side of its silk-covered resting leaf, together with the silk on it, but leave the rest untouched.

Towards the end of September, a week of suddenly severe cold weather killed my two large larvæ just as they seemed about to pupate, and unluckily before I could remove them to a hothouse ; the year had not ended, when the third smaller larva, of which I had great hopes, as being in a more natural state of hibernation, died also. (W. B., 3, 4, 76; E.M.M. XIII, 3.)

#### CYNTHIA CARDUI.

#### Plate VIII, fig. 1.

The following is the account of a curious variety of the larva of this species :

On the 17th of July, 1865, Dr. Knaggs sent me (from Folkestone) a larva he had found feeding on mallow (*Malva sylvestris*). It was then half-an-inch long, with seven rows of spines, all black in colour, except those in the dorsal and subdorsal rows on the sixth, eighth, and tenth segments, which were pale primrose-yellow ; the head and upper surface of the body black, with a double dorsal stripe of pale yellow, and a stripe of the same colour above the legs ; the belly and prolegs deep olive-brown. Unfortunately, it died when about to moult, and though at the time I reported it as an immature *C. cardui*, yet my figure remained doubtful in my mind.

the back of the abdomen, and two broader, pale ashy stripes along the sides, the superior margin of each wing-cover pale ash colour, the antenna-cases and their knobbed tips marked with ashy, an obscure streak of the same tint on the middle of the wing covers, the spikelets ashy, but glossed with gold or silver according to the angle of light. The dark portions of the wing-cases blackish, the thorax and abdomen sprinkled with atoms of black.

Early in the first week of February, 1869, *Cynthia cardui* came forth; no doubt prematurely, from being kept in a warm room. My old puzzle of 1865 is thus made clear, but now, as Mr. Horton suggested, arises the question as to the *how* and *why* of the larva's hairy coat. Had these mallow-eaters become hairy through eating the downy mallows, whilst the thistle-fed specimens, as I have seen more than once, are clothed with spines alone? Or, were they a second brood, thus clothed for protection against possible cold weather in late autumn. (W. B., March, 1869; E.M.M. V., 278.)

#### VANESSA ANTIOPA.

#### Plate VIII, fig. 4.

On the 19th of July, 1883, I received from Herr Ernst Heyne, of Leipzig, four larvæ of this species feeding on birch. The largest proved to be nearly full-grown and measured one inch nine lines in length, and was moderately stout and uniformly so, as it tapered a little only from the third segment to the head and a little at the thirteenth segment. The head is well notched on the crown and somewhat heart-shaped, the thoracic segments transversely subdivided, with deep wrinkles as usual in this genus; all the segmental divisions are deep and likewise the three subdividing wrinkles at the end of each segment, excepting the twelfth segment, which has but one, and that is less deep; the

legs are all well developed; on the third and fourth segments there are four rows of spines (the second segment has none), but on all the other segments there are seven rows, that is, seven spines are planted round the middle of each segment, viz. a dorsal, which is the shortest and a little in advance of the others, sub-dorsal, lateral, and spiracular; these are long and pointed, branched, and beset rather sparingly with fine pointed hairs; they have rather a formidable appearance.

The head is black and slightly glistening, beset with a few black warts, each bearing a fine hair; the skin is of a dull velvety black, without any gloss, but this shows plainly only at the segmental divisions and subdivisions, being elsewhere clothed with a shining pubescence of greyish drab colour, which with the play of light on it causes the retiring portions to look quite pale, while the middle appears dark and dingy after the manner of a velvet surface. A strong lens discloses the fact that every single hair springs from a minute wart of the same pale colour; in the middle of the back of the fourth and each following segment as far as the eleventh inclusive, is a dorsal mark of dark red, through which passes the distinct black dorsal line, though it is narrower in the red marks. These red marks are smooth and naked; the pubescence is a little curved and grows in varying directions, so that the play of light on it is considerable while the larva is in motion. The spines are black and shining and not much branched; the anterior legs are black and shining. The spiracles are black, finely outlined with brownish-green, and inconspicuous. The ventral prolegs are wholly reddish-green with a shining plate above the feet, the anal pair black with reddish-green feet.

At noon on the 20th of July, the above larva ate what I thought was its last meal, and in the course of an hour became quite restless and began to spin threads, when it was put into a cage and soon ascended to

the flat roof, where it began to spin a little and remained quiet, but the next morning I saw it had moved and that two pellets of "frass" had been ejected, whereupon it was restored to its food, on which it at once made a hearty meal, and then slept on the birch twig, having previously taken the precaution to spin a few threads for a secure foothold. This larva was finally full-fed on the evening of the 30th July, and spun itself up to the top of its cage, and the following day hung suspended by the tail; on the 2nd of August it was a pupa. This measured eleven lines in length, and in form closely resembled that of *Vanessa polychloros* in all respects, except that the spiky-points were longer and sharper than in *V. polychloros*; its colour was a very dark and dingy blackish-brown.

In the younger larvæ, which varied in length from an inch and an eighth to an inch and a quarter, the pubescence was more dense, almost with a shaggy appearance, and the naked spots on the back were darkish green, as were also the ventral prolegs; but with the increase of growth the black skin showed more and more between the hairs, which do not grow, and the larva increases in blackness. These larvæ lived only a few days, probably being diseased from having eaten the birch leaves in too dry and withered a condition during their journey hither in a wooden box.

The dorsal row of shorter spines commences on the seventh segment; there is a subdorsal pair on the front division of the thirteenth segment, as also on the anal flap. (W. B., Note-Book IV, 206.)

#### VANESSA POLYCHLOROS.

##### Plate IX, fig. 1.

On the 15th of June, 1870, two full-fed larvæ on elm twigs were received from the Rev. J. Hellins; their length when stretched was two inches.

Their ground colour is black, but more or less sprinkled with ochreous-brown freckles on the back, forming a longitudinal band bounded by the subdorsal spines; in the middle of the back is a dorsal line of black; on the sides the sprinkling of the pale atoms is more of a greyish tint. Spiracles black, surrounded with ochreous-brown; the spiracular puffed ridge is also ochreous-brown; the prolegs and lower part of the sides brown marbled with darker brown, the belly of a smoky black; both are pubescent, especially along the sides and legs, head, and second segment.

The head is black, studded with black blunt points, and rather pubescent with greyish-yellow hairs; all the spines branched, brownish-ochreous, with black points. The position of the spines is this: none on the second segment; the third and fourth segments each bear four, the subdorsal and spiracular; the fifth to twelfth segments inclusive have each seven spines, viz. dorsal, subdorsal, spiracular and sub-spiracular; all the spines are shining and branched. On the thirteenth segment the upper part above the flap has two spines, very nearly in a line with the spiracular row, the flap has also two spiracular spines pointing backwards; indeed, all have rather a backward inclination by degrees from the thoracic segments. The anterior legs are shining black. The head is rather shining.

By the 18th of June these larvæ had assumed the pupa state. (W. B., Note-Book I, 7.)

#### VANESSA URTICÆ.

#### Plate IX, fig 2.

On the 1st of June, 1874, I found a family of the larvæ in their last coats amongst stinging-nettles, *Urtica dioica*. The first moult appeared to have taken place on a small group of nettles, at their summits;

the next moult at a second small group two feet distant from the first ; the third moult at another group about a foot distant, and the fourth moult at about eighteen inches from the large patch of stinging-nettles where I found them ; all these were female plants.

On the 3rd of June they appeared full-grown, the greater part were of the dingy blackish, and dingy greenish varieties, and a few of the more lively colouring of yellow and black. I secured three examples. On the 4th I went to look at them, but the nettles were deserted, only one individual remaining ; their ravages appeared to be from the tops of the nettles downwards to within about a foot of the ground, the nettles being from three to four feet high.

The individual I figured was about one inch and three-eighths in length ; the segments are plump in the middle and with three transverse wrinkles next the segmental divisions ; the head flattish in front, divided a little on the crown, and rather attenuated where it joins the second segment, thickly studded with bristly points and hairs ; the second segment has on each side of the back a few curved hairs ; on the third and fourth segments are subdorsal and lateral spines, on all the others, including the twelfth, are dorsal, subdorsal, lateral, and subspiracular spines ; at the end of the twelfth segment is a small, shining dorsal wart, on the front part of the thirteenth segment are lateral spines, and also on the hinder part ; that is, on each of segments 3 and 4 four spines, on each of segments 5 to 12 inclusive seven spines, and on the thirteenth segment four spines ; these spines being bulbous at the base, tapering to a fine point, and branched with smaller tapering spines.

In colour the larva, which I figured, had a broad stripe of pale bright yellow down the back, the dorsal black line running down the middle of it ; the yellow is followed by a very broad stripe of velvety black, within the upper boundary of which are the subdorsal spines. This is followed by a broad yellow stripe within

which runs a black edged drab stripe, which widens out round each spiracle; the spiracle is oval, black, with a yellow margin situated just under each lateral spine; beneath the yellow the sides and ventral prolegs are of a yellowish drab colour; the anal prolegs tipped with the colour of the others. The anterior legs black and shining; the belly of the same yellowish-drab colour as the side, with a central stripe of faint blackish, interrupted soon after the beginning of a segment. On the back are scattered minute raised dots, which, by the aid of a lens are seen each to bear a fine hair. These are all yellow, and below the spiracles they are more numerous and coarser and closely resemble the glandular hairs of the stinging-nettle. The general appearance of the skin is velvety, the head has a shining black skin, but is so studded with whitish-grey bulbous based bristles, that it looks greyish. The colour of the dorsal spines is yellowish-drab, tipped and branched with black; the subdorsal are darker olive, tipped and branched with black; the lateral and subspiracular spines are yellowish, beset with black points and branches. A little beneath each subspiracular spine are two dusky longitudinal short streaks. The bulbous rooted hairs occur on the ventral surface on those segments without legs.

The butterflies appeared on June 21st, 22nd, 23rd, and 24th, 1874. (W. B., Note-Book II, 66.)

#### GRAPTA C—ALBUM.

##### Plate IX, fig. 3.

On the 26th of April, 1870, I received thirteen eggs from Mrs. Hutchinson, of Leominster, laid on a leaf of stinging-nettle.

The egg is somewhat elliptical, standing on end, the lower end, the largest, is flattened beneath; it has ten projecting ribs. In colour it is rather a bluish-green,

though some were of the colour of an emerald, brilliantly polished, the ribs being paler, of a dull whitish-green. Altogether, when seen through a strong lens, it has much of the familiar appearance of a miniature gooseberry.

They hatched May 5th; the young larvæ were dark slaty-green, with black heads and black hairs. (W. B., Note-Book II, 137).

#### AEGYNNIS PAPHIA.

##### Plate X, fig. 1.

On the 4th of August, 1876, I received from the Rev. J. Hellins eight eggs which had been laid by a captured female.

These eggs had been laid July 30th and 31st, 1876; the larvæ hatched August 13th and 14th, and were placed on potted plants of *Viola canina*; they soon crept under the leaves, and I did not see them again till April 6th, 1877, when I detected one, and subsequently four others, which had survived the perils of hibernation. Of these five, one I afterwards lost; one, when full-grown, was preserved by Lord Walsingham; one was sent to Mr. Hellins (who had lost every one of the larvæ he retained during hibernation), and the imago bred June 30th; and two I kept myself, and treated with such success, that the pair of butterflies, which I bred on June 26th and 27th, were larger and finer specimens than any I possessed before.

The egg in shape is a dumpy cone, laid erect on the flattened broader end and rounded off at the top; the shell with about twenty tolerably prominent, longitudinal ribs, some not reaching to the top, where the others converge on a central embossed space, having again a spot of finer reticulation in its middle; the reticulation between the ribs is not very prominent; the colour, at first pale greenish-yellow and glisten-

ing, turns paler in about a week, and in the middle of the second week paler again, with a leaden-grey blotch near the top showing the place of the larva's head.

The young larva on hatching breakfasts on the egg-shell, and is worth describing minutely, because its appearance changes so much after a moult; it looks shortish and rather stout; the ground colour ochreous-yellow; the head shining blackish-brown, a dingy olive collar on the second segment; all the usual warts large, shining, of a deeper tint than the ground colour, and furnished with stiff bristles; *on the seventh, ninth, and eleventh segments are a pair of lateral, deep, dull brownish-ochreous spots*, which enclose the hinder trapezoidal and the upper lateral warts; on the thirteenth segment the four trapezoidals are soldered into a plate.

On its first appearance in spring the larva is no more than one-eighth of an inch long, having apparently moulted but once before hibernation; the special ornamentation of the seventh, ninth, and eleventh segments is gone, though the ground colour is still ochreous; it now moults, and though similar to its previous ochreous appearance, yet the colours are fresher and the ground is seen to be varied by a dorsal line of brown, widening somewhat diamond-fashion through each segment, and met by oblique lines from two darker brown subdorsal spots placed at the beginning, and a similar pair of spots at the end of each segment; the sides brownish, broken with ochreous, with a paler subspiracular region, the belly brownish; the ochreous pale portions of the colouring are glossy, the brown parts dull; several series of warts, each with a bristly hair, indicate the position of the future spines. The head is black.

After another moult, some time between April 12th and 20th, the spines appear, they are alike short and stumpy, pinkish-brown in colour, with black tips and branches. The head and body are now black, with double lines of whitish-violet on the back. At this

time the length of the larva is about three-sixteenths of an inch.

At the next moult, after an interval of about ten days, the details and colours are much as before, and the general appearance is very dark and black. Another moult and the larva soon becomes three-eighths of an inch long, and shows the two lines on the back to be ochreous-yellow, and the sides brownish-ochreous.

From this point I shall speak especially of one individual, the most forward, which I kept apart from the rest and to which I paid especial attention ; this one moulted again on the 29th of April, when it seemed much exhausted ; it waited four hours before moving and then hid itself under another leaf, remaining there without further movement for twenty-nine hours more, and only beginning to feed again on the 1st of May. It now ate out small segments of circles from the edges of the violet leaves, and after eleven days' steady feeding and growth, I found its length had increased to five-eighths of an inch ; the spines at this stage differed in colour, those of the upper row being pinkish-ochreous with black tips, the first pair blunt, those of the lower rows black with reddish bases.

The penultimate moult occurred on the 13th of May and gave the extra length to the first pair of spines behind the head, with their blunt tips black ; all the other spines amber-yellow. On the same day, only three hours later, another individual was well over the corresponding moult, and to this one also I devoted especial notice ; of the remaining two larvæ still kept together, it will be enough to say here that they showed the extra length of the front spines on the 15th and 16th of May. The growth of all continued, and in seven days the first, specially noted above, was a little over an inch in length, and the second about an inch ; neither appeared up to this time to feed very often, but each made a good meal twice a day.

I observed the first larva, in preparation for its last

moult, fixed belly upwards to the underside of a leaf on the 20th of May, and remaining quite still until noon of the 25th, when I noticed it moving its anterior legs a little free from the leaf, a circumstance which claimed my whole attention ; it was but a slight movement and was repeated at intervals of about half an hour, until between two and three o'clock in the afternoon, when it began to stretch its first segments downwards from the leaf, making the fore part of the back concave, and then presently gently reversing the movement. It continued thus at short intervals to increase the stretching curve of the body so much, that by ten minutes past three its hold on the leaf was retained only by the fourth pair of ventral prolegs and the anal pair, when suddenly the skin snapped asunder close to the head, with quite a shock to the larva, which instantly returned its ventral prolegs to the leaf, while the elastic skin, relieved of its tension, was itself from the impetus of the rupture gliding backwards. The anterior legs were held back until divested, and then returned forwards to their natural position one after the other, but kept just free from the leaf, each pair being elevated in unison for a moment, and let fall, as though to test their complete freedom ; otherwise the larva remained passive, the skin only continuing to move backwards, and whilst passing the ventral prolegs, each foot in turn was lifted up out of it, and then replaced on the same spot of the leaf, and when the old skin had shrivelled up together at the end of the body, the larva, with all the ventral prolegs, took two steps forwards and drew forth the anal pair free.

At the first breaking of the skin the head became exposed, with the old head-piece adhering to the parts around the mouth, but now, at last, the larva gave its head a sudden twist or two, and the old piece fell off ; from the rupture of the skin to this final riddance the operation occupied nearly ten minutes ; the spines were all uncovered in a remarkably small and rudimentary, wet and flaccid condition, the front pair even smaller

than the others ; but now this pair began gradually to grow, and in fifteen minutes were far longer than ever, and in another half hour all the other spines had grown considerably, both in length and rigidity ; after this the larva remained still for two and a half hours longer.

The second larva gave me an opportunity of verifying these observations on the 27th of May, commencing its last moult at 5 p.m. on that day, and behaving in precisely the same fashion ; when I saw the front legs held back and again dropped forward with the natural motion of relief, after being freed from the old skin, I was reminded of the familiar manœuvre of one's being helped off from behind with the sleeves of a tight overcoat.

The second larva had fixed itself on only a part of a leaf, too narrow to admit of any stepping forward, but it knew how to meet this difficulty, for when the sloughing arrived at the first ventral prolegs, the larva fidgeted a little with the anterior legs, but finding nothing they could touch, and remembering that no advance was possible, it kept its place until the final moment came, and then disposed of the difficulty by arching the hinder part of the back convexly downwards from the leaf, and with a strong effort pulled out the anal prolegs by a downward, not a forward motion.

The largest larva previously noted made enormous meals for the last ten days, freely exposing itself on the violet plants ; but towards evening, on the 7th of June, it became restless, and wandered actively over the plants, the earth, and the protecting glass cylinder, impatient of confinement, and late at night found its way to the leno covering at the top. Next morning it was still there, but much shortened, and engaged at intervals in adding to a layer of silk already partly spun ; in the afternoon it turned itself round, so as to insert the anal proleg hooks in the small tuft of silk prepared in one spot, deliberately testing the strength with each foot in turn by a visible pull, the ventral

prolegs holding on to the thinner silk layer spread before the tuft, but the head and anterior legs quite free from it ; thus it remained for nearly five hours, and then suspending itself by the anal prolegs only, it changed to a chrysalis on the 9th of June.

The full-grown larva measures from about one and a half to one and five-eighths of an inch in length and is in proportion rather stout. The broadish head has the lobes produced angularly on the crown by projecting tubercles, with stout pointed hairs, the ocelli prominent ; the second segment wider than the head, and the bulk again increasing to the fifth, decreasing again from the tenth to the thirteenth ; the spines are in three rows on either side, bulbous based, pointed, and branched with finer hair-like spines of varying lengths ; in position they are subdorsal, lateral, and subspiracular, six on a segment, except that the thirteenth has only four spines, and the three thoracic segments have on their sides *only two* spines, and these placed on the segmental divisions laterally, *i.e.* one between the second and third, and one between the third and fourth segments. As some compensation, however, the first pair of subdorsal spines, as already noted, are of extra length, with blunt tips, and directed over the head, and there are also on each side of these segments from three to five wart-like tubercles, each bearing a pointed bristle ; similar bristled warts, in a transverse series, are seen on the belly of the fifth, sixth, eleventh, and twelfth, and the intervening segments have a longitudinal row of four or five just above the outside of each ventral proleg.

The colour of the head and its numerous hairs is black and glistening, with a marbling of pale yellow on the crown, upper lip ochreous. Down the whole length of the back are two stripes of brilliant yellow, rather inclining to ochreous and sulphur at either end, separated only by a black dorsal line ; these stripes are still more conspicuously relieved by a black, velvet-like bordering of markings, broad and unbroken, as a

spot in front of each subdorsal spine, though finely edged outwardly with brownish-ochreous, and also behind the spine with the same colour, and two faint curving lines of it breaking there the black ; the ground colour of the sides, just as far as the lowest row of spines, is velvety-brown, adorned along the middle by a series of rather fusiform, black, velvety marks, one on each segment, intersected in the middle by the lateral spine, and finely edged with brownish-ochreous ; some short rudiments of other fine ragged lines of this colour occur on parts of the ground, but become very faint along the spiracular region, where a few freckles appear of lighter ochreous. The oval spiracles are black. The spines are of a reddish-ochreous colour, with their extreme tips and branches black. The belly is of a dull blackish-brown, abruptly contrasted with the side, and rather inclining to chocolate-brown at the segmental divisions ; the warts paler and glistening, hairs black. The anterior legs black, shining, and hairy, as are the ventral and anal prolegs above, but pinkish and smooth below, with a fringe of blackish hooks on the feet.

The chrysalis, about an inch long, when seen sideways is deepest across near the end of the wing-covers, and the largest projecting points ; seen in front it is broadest across the bases of the well-defined wing-covers, which project laterally in curved ridges from the thorax—itself rather sharply keeled in the centre,—from this is a deep depression, and thence again the abdomen swells out in a backward tapering curve to the point by which it is suspended ; in the subdorsal region, on each side of the back, is a row of obtuse, tapering, prominent points, smaller in the depression, and much smaller still on the thorax ; a larger pair at the head are suggestive of ears. The pupa skin is of a dull fawn-colour, varied with paler and with fine brown reticulation. There is a line of brown along the spiracles, and a stripe of a darker brown on each side beneath the abdomen ; a fine, rather wavy, line of dark-

brown near the margin of the wing-covers, and in the depression of the back are large glittering, golden basal spots to the points there, and the tips of the other abdominal points have a similar golden lustre. (W. B.; E.M.M. XIV, 252.)

#### ARGYNNIS ADIPPE.

##### Plate X, fig. 2.

On the 29th of June, 1867, I received a larva, which I had no doubt was referable to this species, from the Rev. E. Hallett Todd; he had found it a day or two previously on *Viola canina*.

I figured it a second time on the 7th of July, when it had a little increased in size and its colouring was a trifle darker. But at last this larva showed symptoms of disease, some part of its interior protruding a little from the anal flap, and on the 11th of July it died, to my great mortification and regret.

It had just attained the length of an inch and a half. (W. B., Note-Book II, 127.)

On the 20th of August, 1877, the Rev. J. Hellins, who was then at Chagford, Devon, sent me a female *Argynnis Adippe* alive. She was placed on a potted plant of *Viola canina*, protected by a glass cylinder, and by the 25th had laid about twenty-five eggs on the plant, chiefly on the underside of the leaves and on the stems, twenty-three eggs on the lower tin hoop of the cylinder, including two on the glass, and six eggs on the earth under the plant.

On the 25th I received eight eggs laid by another ♀ *Adippe*; these had already changed colour. On the same day I received as many as seventy-eight eggs of *Adippe* from Mr. W. H. Ballett Fletcher, of Lyndhurst; these had been laid on green leno, he having imprisoned three ♀ *Adippe* in a cage lined with that material during his absence in the Forest for a day.

These eggs were placed as well as a few others on the leaves of *Viola canina* and *odorata*, which were put in the cage.

The shape of the egg is conical, the base broad having a central depression, the sides are very boldly ribbed and reticulated, some ribs being longer than others and reaching to the apex where they turn down a little. When first laid its colour is a glistening light ochreous-green, becoming in three or four days rather pink, afterwards deepening gradually to a rosy red, the ribs showing paler. At this time the top of the egg between the ribs soon assumes a deep carmine hue, softening into light greenish at the base ; the egg changes again to a more dingy pinkish all over, no longer glistening but very dull.

By the end of September the eggs had grown very much paler in effect, owing to the ribbed reticulation becoming rather whitish, but beneath the ribs there now appeared at the top of the egg a dark grey blotch.

The eggs from Mr. Ballett Fletcher were greyish-green all through the winter, and towards the end of February, 1878, looked more of a bluish-green than before, and on the 1st of March the ribs of some few became whitish and a dark leaden internal blotch was visible through the shell near the top.

On March 2nd I saw at midnight that five larvæ were hatched. March 4th, two more at 5 p.m. March 7th, one at midnight. March 21st, one at 5 p.m.

The newly hatched larva does not eat any more of the egg-shell than the hole at the top for its escape ; it is rather an active little crawler. At first it is of a brown colour, with a shining black head, and has a very small black-brown plate on the middle of the second segment, and is decidedly hairy. All these larvæ excepting one fell a prey to slugs introduced with the plants. The solitary larva which survived grew very slowly ; in April it was very small and dark coloured as before, in May it grew a little and by the end of the month was about a quarter of an inch long, with blackish

head, and black body, finely marbled with dirty greyish-whitish, and a stripe of this paler colour above the legs, the spines all black. By the 7th of June it was half an inch long, the body still black, finely varied with minute faint whitish markings ; and now for the first time the spines were pale ochreous-brownish in contrast to the body. By the 14th of June it was nearly five-eighths of an inch long and stout in proportion, the spines all pinkish-ochreous, thickly branched with black; head black, and the general appearance of the body was black, though faintly paler pinkish-grey markings could be just discerned as follows : the general ground black, thickly sprinkled with atoms of violet grey ; at the beginning of each segment on the back, in front of the pair of subdorsal spines, was a crescent or semi-lunar mark of unfreckled black, velvety by contrast with the other parts of the skin ; these were divided dorsally by two short fine violet-grey lines, which ended with them ; three lines of the same colour and freckly character ran along the side longitudinally, interrupted only by the spines, and a stripe of the same ran along by the lowest or subspiracular row of spines ; the belly, too, was blackish, freckled with violet-grey ; anterior legs black, ventral and anal prolegs reddish-ochreous below, black above ; the mouth reddish ochreous.

On the 23rd of June this larva moulted and its spines became noticeably long in proportion. I figured it on the 26th, when its length was one inch and an eighth. On removing it at first it was shy and curled up for several minutes, then stretching itself out gradually it set off to run at a pace quite equal to the fastest larva of *Arctia Caja* !

The number of its spines was just the same as in *A. Paphia*, but the first dorsal pair though directed over the head were rather shorter than the others ; beyond the thoracic segments each segment had six spines except the thirteenth, which had only four ; a lateral spine between the second and third, another between the third and fourth, were the only additions to the

subdorsal spines on those segments, but there were several warty tubercles at the sides and beneath bearing hairs, as in *Paphia*; in colour it was deep reddish-ochreous, finely freckled with rather paler reddish flesh-colour and with black; the dorsal line with the paler freckles was distinct throughout and passed through the semilunar black velvety mark at the beginning of each segment; along the sides were longitudinal triple sets of ragged black velvety streaks, like slashes in a doublet (the second row of spines standing in their midst), and a somewhat V-shaped black mark, wanting the point, was visible towards the end of a segment; the black marks were all most delicately edged with freckles of the paler colour, the bulbous base of each spine deep strawberry red; the head red, thickly freckled with black; the extreme tips of the subdorsal spines were black, all the others ochreous, the finer branches black; belly dark red, finely freckled with ochreous; anterior legs black. When feeding its meals were taken in a most rapid or hurried manner.

On the 29th of June the Rev. J. Hellins sent me one of his larvæ of *Argynnis Adippe*, he having now only two left, one large and one small. The one he sent me was about one inch and a quarter in length, quite of a dingy pinkish-brown, minutely freckled with paler atoms. On the 12th July I figured it when it was an inch and a half long and stout in proportion, coloured just as before, the spines pinkish ochreous, the dorsal line a paler tint of pinkish flesh-colour; the beginning of a segment had the usual black velvety semilunar mark, finely edged on either side by pale violet; the segmental folds were violet; near them were a few dark freckles on either side of the dorsal line, and this line was a little obscured with the brown colouring on the middle of each segment.

On the 12th of July the Rev. J. Hellins had a larva of *Adippe* spin up; on the 17th of July I received from him the pupa, suspended by the tail. It was a little more than three quarters of an inch in length and

rather stout in proportion. The thorax keeled on the rounded swelling back, thence a deep depression, from which the abdomen swelled out in a gentle backward curve, which increased just towards the tip of the tail; two rows of rather blunt pointed obtuse projecting spines represented the subdorsal spines of the larva. The wing-covers were long and well developed, and by the side of the thorax their margins stood boldly outwards with a prominent ridge, forming the greatest breadth of the outline in front. The head was somewhat squarish in outline.

At this time the colour was of a pitchy brownish blackness with a row of dorsal diamond shapes of less intensity of colour, the margins of the wing-covers deep brownish-ochreous, the spiky projections golden and brilliantly glistening—all the rest of the surface glistening.

Of the larvæ previously mentioned, that which I had received from the Rev. J. Hellins spun itself up under one of the leaves of its violet plant, and there died, only partly changed, an aborted pupa. The other which I reared from the egg died whilst still in the larva state, on the earth beneath the food-plant.

The only way I can account for these misfortunes is in supposing that they were kept too hot in the sunny window. (W. B., Note-Book III, 210.)

On the 7th of August, 1882, I received from Mr. W. H. B. Fletcher about twenty-six eggs of *Argynnis Adippe*, laid upon leno and standing on their bases by which they adhered. The shape of the egg is conical, with the base rather rounded, it has apparently about fifteen projecting ribs, some of them shorter than the others, the longest extend nearly to the apex, but do not quite meet there, a small central circle being left plain, and the ribs are beaded or reticulated; a few are pale straw colour, but the rest are only this colour at the base for a short distance, their upper part being rose-red, others are wholly red, all have a narrow whitish faint zone

not quite completing the circumference a little above the middle ; in the course of a week or two the colouring changed to a greenish-grey, and by the 13th of September the ribs were thus coloured and also the reticulation, which made the whole egg appear of the same hue ; the centre of the top of the egg was a little depressed. At this date I placed them in a cage out-of-doors.

With regard to the egg of *Argynnis Adippe*, Mr. Fletcher has made the following observation : " I think that the larva is fully formed in the egg shortly after it is laid, for the egg then takes a purplish tint which does not change till the larva is hatched. The fact that I had two eggs for at least a fortnight with great holes, through which I could with a lens see the larva move, which larva hatched when put in a very warm place, seems to support this view.

At noon on the 14th of February, 1883, four larvæ hatched and were put on *Viola canina* ; they were not very sluggish, and had a blackish head, and very dingy greenish body, with a blackish spot on the middle of the second segment, a very faintly darker dorsal line, and a row of tubercles of the ground colour bearing fine hairs on each side of the back and sides from six rows of tubercles ; the colour of the belly was a trifle paler than the back.

On the 22nd of March I received from Mr. Fletcher six more larvæ of the same brood, two of them had recently moulted the first time ; these measured  $2\frac{1}{2}$  mm. in length, and were of a deep bright green colour, the head black and with a few fine, short, black hairs ; on the second segment across the middle was a narrow row of dark brown tubercles, all the other segments showed a dark blackish-brown dorsal v-like mark at the end of each segment, these marks were shorter on the third and fourth segments ; they were followed outside by paler greenish, indicating the subdorsal line ; the sides were of the ground colour, and above the legs was a faintly paler greenish line ; the rows of

tubercles were all dark brown and had black short pointed hairs.

On the 20th of April I observed the same larva noted above, and suppose it had passed its second moult, though I am not sure; it seemed to be of a greenish-ochreous colour, with a black head, and with blackish chevrons on the dorsal region and a darkish patch on the side of each segment; a faintly paler subdorsal line could be traced and also a spiracular stripe; hairs or spines black, and a narrow line of these across the middle of the second segment.

On the 21st of May my larvæ had all disappeared, as no larva could be found on either of the plants which had thriven well. I must say that I much doubt whether *Viola canina* be the proper food plant of *Argynnis Adippe*. (W. B., Note-Book IV, 157.)

#### ARGYNNIS AGLAIA.

##### Plate X, fig. 3.

On the 29th of June, 1867, I had the gratification of seeing this larva, which was most kindly presented to me by the Rev. Hallett Todd.

It was found with others after a strict search amongst *Viola canina*, and its mode of feeding on the leaves of that plant was peculiar; for, when eating, it kept advancing with every mouthful until it had got to the end of the leaf, and then quickly walked backwards to the point of commencement, and proceeded as before, always making a quick retrograde movement before again eating its way forward; and these operations were performed with such rapidity that half a large leaf quickly disappeared. When its hunger was appeased, it usually retreated below the leaves or rested on the stalks of the plant.

When nearly full fed it measured an inch and five-eighths in length, and tapered a little towards the head

the second, third, and fourth segments being exceptionally tipped with black, while the two lateral pairs are whitish at the base.

The ground colour of the full-grown larva is a velvety smoky-pink ; there is a dark brown dorsal line, which throughout its course expands and contracts twice on each segment ; in front of each subdorsal spine, and partially enclosing it, is a velvety black spot, delicately edged with whitish, while behind each spine is a blackish interrupted streak ; immediately beneath the whole row runs a much interrupted dark brown line ; broad black spots are placed also in front of the spines in the lateral row. The spiracles are black, set in ovals of a pinkish tint, rather paler than the ground colour ; and below them, bearing on it the subspiracular row of spines, runs an inflated stripe of pinkish-red paler than the ground, showing faintly and interruptedly on segments three and four, but distinctly throughout the remainder. The belly is of a deep pinkish ground colour, freckled with dark brown on the sides ; prolegs pale pink, tipped with blackish-brown ; the anterior legs black and shining.

Most of the lines or streaks are more or less broken by a sort of warty or granulated texture of the skin in places, each little wart being of the ground colour, emitting a minute soft hair, so that the body has a delicate and scattered pubescence.

The pupa is suspended head downwards ; it is about half an inch in length, thick, and obtuse in front, the abdomen thickest in the middle, thinner near the thorax ; on each side of this part the edges of the wing-cases project, thus forming a cavity ; the tip of the abdomen, viewed in profile, is blunt and rather abruptly curved back to its point of attachment ; the eye and antenna cases are well developed, but all angles rounded off ; the subdorsal rows of the larva are still represented by two rows of blunt spikelets—not very projecting—along the back of the abdomen.

In colour it is brownish-ochreous on the wing-covers,

brown on the abdomen and thorax, and darker brown round the concave part of the abdomen ; on the beginning of the keel of the thorax is a black  $\vee$  mark pointing towards the head, with a silvery metallic spot on either side, and one on each side of the head ; other metallic spots are at the base of the four pairs of spikelets next the thorax, the first pair the largest : towards the tip of the abdomen three pairs of the spikelets have a dark brown curved streak from each, uniting in front, and pointing forwards. The spiracles are plainly visible and black ; behind them is a stripe of pale brown. The wing-cases have at their terminal borders two large blotches of black, another towards the middle, one at the base of the wing and one on each of the eyes ; the ground colour most delicately reticulated with blackish-brown.

Unlike its congener *Euphrosyne*, the larva of *Selene* has an aversion to the sun's rays, and does not at any stage of its larval existence care to expose itself to their direct influence, but reposes either on the undersides of the leaves of the food-plants, or else on the stems while shaded more or less by the leaves, and feeds while young, and indeed nearly up to its last moult, on the youngest and tenderest leaves of the violet, but thenceforward has a more accommodating appetite, and attacks without much choice any of the mature leaves, eating out large portions of them at a time, and in a few days making considerable ravages on the plant. (W. B. 13, 8, 70; E.M.M. VII, 114.)

#### ARGYNNIS EUPHROSYNE.

##### Plate XI, fig. 2.

For many years the adult larva of *Euphrosyne* had eluded the care and search not of myself only but of several of my friends.

We did not find any difficulty in getting a female to lay its eggs, which in due course hatched and produced

the young larvæ, but the disappointment lay in the hibernation. We never could get a single larva to feed up in the spring, nor could we, with all our searching in fit localities at that season, ever detect a larva feeding at large. However, our attempts, though fruitless in one point of view, made us acquainted with the earliest stages which I will give before proceeding to the full-grown larva.

The egg is of a blunt conical shape, with its lower surface, which adheres to the leaf, flattened, its sides are ribbed ; at first it is of a dull greenish-yellow colour, becoming afterwards brownish. Towards the end of June the larva is hatched, being then of a pale greenish tint ; after its first moult it becomes browner-green, and about the middle of July it attaches itself to the plant and ceases to feed.

On one occasion I prevented this early beginning of hibernation by keeping a larva in a hot sunny window, and at the end of July I had the satisfaction of seeing it half an inch long ; it was then black and spiny, with a faint indication of a dull whitish stripe along the sides above the feet, but unluckily after its hibernation had commenced it was killed by mould settling upon it ; and up to last spring this was all I had to record.

But on the 1st of April, 1868, I had the indescribable pleasure of receiving a larva of this species, most kindly presented to me by Mr. W. H. Harwood, of Colchester, and which he had found during a walk through a wood ; his attention having been for a moment arrested by a leaf of primrose being much eaten, and on turning it up he detected the larva adhering to it.

From its size and appearance being similar to the one above mentioned I felt sanguine in having now a chance of observing and rearing a larva to the perfect state. When received it was barely half an inch long, covered with spines and black, except a stripe formed of whitish freckles running along above the legs ; but on the thoracic segments only were they so thick as

to make the stripe there appear much whiter than on the others.

A very faint edging of greyish helped to make the black dorsal stripe visible. The spines and legs were black, and large in proportion; the prolegs of a dark smoky tint, inclining to reddish.

It at first refused to eat when placed on growing plants of dog-violet and primrose, but within twenty-eight hours it moulted, and then, when the sun shone on it, its appetite returned. Its pace when walking was very rapid; sometimes it fed for a while on the dog-violet leaves and sometimes rested quite still basking in the sun's rays; when these were withdrawn it retired to the underside of a leaf and there remained, apparently without motion, till the hour (viz. 2 p.m.) of the next day which brought the sun round to the window in which its cage was placed, and then at once it came forth and walked actively about, fed and basked as before. After a few days it began to appear unwell, ceased to feed, remained on the earth, and kept out of sight for about four or five days.

Towards evening of the 12th of April it re-appeared and greatly rejoiced me by showing itself on the side of its glass cylinder in a new coat of black velvet, ornamented with a subdorsal row of bright greenish-yellow spines with black tips and branches, all the other spines being wholly black; the prolegs now appeared dull pinkish.

By the 16th of April its pale stripe above the legs had become visible, but greyish in tint, the whitest portion being on the third and fourth segments, the whole of the back remaining of a deep velvety-blackness. The greyish-white stripe above the legs was formed by a series of whitish spots with black centres, and as they were more or less aggregated, so the appearance was whiter or greyer. The anterior legs black; prolegs with their tips brownish and semi-transparent; the ventral surface brownish-black.

Towards the end of April it attained its full dimen-

sions, about an inch long and rather thick when in repose, but when stretched out and walking one inch and a quarter in length. As it approached its full growth the whitish lateral stripe became more and more visible, and appeared divided into two by a blackish rather interrupted line running through it from the fifth to the anal segment; faint indications appeared of a greyish subdorsal line, especially at the segmental divisions when stretched out, and the black dorsal stripe was also made visible by its edging of greyish; the subdorsal spines remained greenish-yellow with black tips and branches to the last, the front pair slanting a little over the head; the head itself black, and beset with short obtuse black spines; the lateral and subspiracular rows of branched spines were brownish-black, and all were slanted a little backwards.

At the end of the month it seemed rather sluggish, and on May 3rd it disappeared amongst the leaves of the dog-violet which had formed its whole sustenance, with, I believe, only one exception, when I saw it eat out a small piece from a leaf of primrose.

On May 5th it had changed to a pupa, suspended by the tail to a circular mass of silk spun upon the side of the glass cylinder, hanging about three-quarters of an inch from the earth.

The pupa, five-eighths of an inch in length, was moderately stout and rather sharply pointed, and curved at the tip of the abdomen, and with a depression next the thorax; the wing-cases long in proportion and dull brown in tint, with two rows of pale greyish dots near their margin; the spiked processes of the head and the back of the thorax pale greyish; the back of the abdomen brown, with subdorsal rows of blackish spikelets, bordered on each side by a stripe of pinkish-grey, and near the underside of the abdomen another such stripe.

The butterfly came forth on the morning of the 23rd of May. (W. B., E. M. M. V., 125.)

## MELITÆA ATHALIA.

## Plate XII, fig. 1.

On the 16th of May, 1871, I received from my friend Mr. W. H. Harwood, of Colchester, six larvæ of *Melitæa Athalia*, which he had found, along with many more, feeding on *Melampyrum pratense*.

As this was not known as a food-plant of the larva, Mr. Harwood's discovery is of unusual interest, and it may be well to record precisely how it took place. On a warm day in May, 1871, Mr. Harwood was sitting under a tree, discussing his lunch, when in compliance with that curious law which, as Mr. Stainton long ago made us observe ('Entomologists' Weekly Intelligencer,' vol. i, p. 113; vol. viii, p. 193), so intimately connects the entomologist's *al fresco* meals with interesting discoveries in insect economy, his attention was arrested by the movements of a dead leaf lying amongst others on the ground before him. Presently the head of a larva was protruded; a further examination showed that its owner was engaged in eating a small plant of *Melampyrum pratense*, and was but one of a large colony similarly engaged.

In previous years my friend had captured the imago of *Athalia* in this locality, and had been puzzled, because its generally reputed food-plants, *Plantago major* and *lanceolata* could not be found there; but now the secret was told, and although I have no doubt but that, under varied conditions of locality and climate, the larva feeds on various plants, yet I cannot help thinking that in many of the English habitats of the species *M. pratense* must be its food. *Melampyrum sylvaticum* has I know been given in the list, but as this seems to be a rare plant in Britain, and not to be known in many places where the butterfly occurs, I am inclined to believe that a small variety of *M. pratense* may have been mistaken for it.

To the larvæ which Mr. Harwood sent me I offered the choice of *Melampyrum pratense* and *Plantago lanceolata*, but found the latter plant quite neglected by them, even when they had finished up their supply of the former. On the 24th of May they began to suspend themselves to the undersides of the leaves, and to the sides of their glass cage, and on the 27th they had all assumed the pupa state.

The perfect insects, of an unusual depth and richness of colour, and of maximum size, emerged from the 27th to the 30th of June.

The full-grown larva is about one inch in length and moderately stout ; viewed sideways, it is of about uniform bulk throughout, viewed from above, it is seen to taper slightly just towards each extremity ; the head is indented on the crown, is widest at the sides near the mouth, and rather flattened in front ; the body is thickly covered with obtuse conical spines, to the number of 113 as follows : the segments from the fifth to the eleventh, both inclusive, bear each eleven spines, arranged in a single transverse row on the back and sides ; or, if they are regarded longitudinally and collectively, we may say that on segments five to eleven inclusive there are eleven rows of spines, viz. the dorsal and on each side the subdorsal, supra-spiracular, sub-spiracular, lateral, and sublateral ; the other segments have as usual a different arrangement ; the second segment bears but two spines on each side, which are in a line with the lateral and sublateral rows ; the third segment has ten spines, the dorsal one only being absent ; the fourth segment has eight spines, the lateral as well as the dorsal being absent ; the twelfth segment bears ten spines, the single dorsal being here replaced by two, i.e. one in front, the other at the hind part of the segment, whilst the lateral pair are absent ; the thirteenth segment has but four spines, which stand two on each side, in line with the supra-spiracular row of the rest ; of all these spines, those in the two lowest rows are the most slender and smallest, and those in the subdorsal rows are rather the largest.

The ground colour of the back is black, becoming gradually blackish-olive on the sides, the belly olive-brown, the anal flap and also the segmental divisions olive; all the skin is thickly covered with whitish spots that are very slightly raised, giving it a tessellated appearance, except that a dorsal stripe of the black ground is left. The spots on the back are somewhat transversely oblong, but rather irregular in shape, and are disposed partly in three transverse rows between the spines of one segment and those of the next, and partly round the bases of the spines; on the sides the spots are rounder and smaller, and are chiefly congregated round the spines and spiracles; there is a lateral series of three large irregular spots on each segment beneath the spiracles, which almost forms a broadish longitudinal stripe. The head is black, with a transverse whitish stripe just above the mouth, and a group of whitish spots on the crown of each lobe, which, as does the rest of the head, emit fine black bristly hairs; on the front of the second segment is a narrow, raised, semicircular plate of greyish flesh-colour, also emitting black bristly hairs; the colour of the spines of the dorsal and subdorsal rows is orange-ochreous, growing whitish at the tips and of the dorsal row also rather pale at the base; those in the supra-spiracular row are of a paler ochreous tint, with more of their tips whitish; the three other rows below the spiracles are all whitish; all the spines are thickly set with straight, short, pointed black bristles at an acute angle, and for the most part each white spot on the body emits a fine, short black hair; the spiracles are black, ringed with whitish; the anterior legs black, the ventral prolegs of a pellucid drab colour tipped with darker drab hooks.

The pupa is half an inch in length, very plump, with the usual angles much rounded off; the abdominal rings bear little rounded eminences—traces of the larval spines; the tip of the abdomen is bent back at nearly a right angle, and there is a slight depression between

the abdomen and thorax, which is broad and rounded. The wing-covers are well defined and rather prominent; the warmish white colour and texture of the pupa skin may be compared to that of biscuit-china; each abdominal ring is adorned with a transverse brownish-orange bar, having on its hinder edge squarish black spots, or sometimes a black bar with orange spots, and followed by a row of tiny black dots. The back of the thorax is marked with triangular streaks of black, outlined with orange; the antenna-cases and wing-nervures are faintly marked with orange-brown, and the wing-covers and the eye- and leg-pieces with strong black blotches and dashes. (W. B., 3, 72; E.M.M. VIII, 258.)

#### MELITÆA ARTEMIS.

##### Plate XII, fig. 2.

I received eggs of this species from Mr. Joseph Merrin, of Gloucester, on the 12th of June, 1871. Mr. Merrin wrote that he secured some pairs of these butterflies *in cop.* and put the females on growing plants of *Scabiosa succisa* (Devil's bit scabious) in pots. "The eggs are laid in heaps of a hundred or so on the face of a leaf." The eggs which I received were in two clusters and a few single ones.

In shape the egg is ovate, *i.e.* largest below and smallest above, truncated at the top, and slightly flattened at the bottom, ribbed from the top for about half their length, and the rest smooth. They shine much as though varnished, and are of a pale brown colour. (W. B., Note-Book I, 110.)

On the 23rd of April, 1883, I received from Mr. Stainton four larvæ of *Melitaea Artemis*, which had been sent to him for determination from Swindon, in Wiltshire. They were of different sizes, ranging from five to eleven lines in length. They were velvety-black with black spines, short and blunt tipped, with

short, radiating, black and pointed hairs. The belly and ventral prolegs green. There being no white band along the spiracular region they appeared wholly black above ; nevertheless, with a strong lens I could descry minute leaden-coloured warts glistening in the spiracular region, forming as it were a band of white specks. These also had on the black head a green transverse streak above the upper lip.

These larvæ fed very sparingly on leaves of *Scabiosa succisa* and of honeysuckle. By the 1st of May one had died whilst comparatively small, but the three survivors had consumed many whole leaves of the scabious, and were very active in crawling whenever the sun shone on them. This they seemed greatly to enjoy, and to like each other's company, as they kept constantly together night and day.

The two largest had now their black velvet coats relieved by the minute, round, whitish, glistening warty spots, which were numerously sprinkled over the dorsal surface as far as the subdorsal spines. The sides were generally without any until close on the spiracular region, where they were still more thickly aggregated, and formed a lateral band of shining specks, of which as none were confluent the effect was greyish. The spiracles were oval and black, margined with whitish. There were nine rows of black spines, viz. dorsal, subdorsal, supra-spiracular, spiracular, and sub-spiracular, the dorsal row standing a little in advance of the others . . . (W. B., Note-Book IV, 37.)

#### NEMEOBIUS LUCINA.

#### Plate XII, fig. 3.

On the 3rd of June, 1870, having captured two butterflies of this species, I put them on cowslip. Four days afterwards I found that they were dead, but on removing the cylinder which protected them

one or two eggs were to be seen laid on the underside of the cowslip leaves.

The plant was put aside and forgotten for three weeks or so when I brought it out to inspect, and found that the eggs had hatched. A cylinder was then placed over the plant, and the next day three larvae were to be seen making holes in the leaves. At this time they certainly seemed rather of an onisciform shape, but this form soon began to disappear, and as they approached their full growth the ravages they made on the leaves of the plant were very great.

By the 18th of July they were about three-quarters of an inch long, rather thick in proportion, the head smaller than the second segment, and the second a little smaller than the third, the outline of the back a little convex in shape, and the last three segments tapering a little.

The colour of the head was pale orange-brown, that of the back as far as the spiracles of a deep ochreous-brown, the surface being composed of warty swellings, which on the back especially, though rather less so on the sides, were covered with a fine down or shaggy pubescence, and in addition each wart emitted a fascicle of stout, bristly, rather curved hairs.

Below the spiracles the colour was of a paler brown, sometimes greyish. The warts above the legs were furnished with pale, whitish-brown, curved hairs, forming a complete lateral fringe, the prolegs equally pale. The dorsal stripe was only visible as a black spot towards the anterior part of each segment. The spiracles were of the ground colour strongly outlined with black. (W. B., Note-Book I, 40.)

On the 29th of May, 1879, the Rev. J. Campbell Parson brought me a pair of this species taken *in cop.* They were placed on the 31st on some potted plants of cowslip. The male lived nine days and the female fifteen.

On the twelfth day five eggs were visible laid on the upper surface of a leaf, some near the middle of the

midrib ; another was visible on the underside of another leaf near the lower edge. On withdrawing the grenadine cover after the death of the female and examining the undersides of some broken leaves several little groups of eggs came into view. Altogether I counted fifty-two.

In a few days two of them appeared infertile as they remained colourless like clear glass. The others from the first were of a very pale greenish-yellow, becoming in a few days less transparent, but the shells very glossy as at first. On the 16th of June those first laid on the upper surface of a leaf changed to a pinkish-grey colour, and were marked with a very delicate black diamond-shaped reticulation ; a black spot showed also on one side of the egg. The shape of the egg was globular, the shell smooth-surfaced and highly polished.

In the evening of June 16th two of the eggs showed a central circular cap gone from the top of the shell, and a slight movement was perceptible of the apparently glistening brownish skin of the imprisoned larva. The next morning those five eggs were hatched, and one of the larvæ was eating away round the circumference of the shell it had quitted, the others having evidently breakfasted in a similar way, as the clear glassy shells were so much eaten down.

The larva at this early time being of light-brown colour, with a shiny clear brown head, with distinct black ocelli, and with longish black hairs on the back and sides of the body, these characters explained the reticulated appearances on the egg, and the shining head was what had appeared through the top of the shell. The head is rather large in proportion to the body, but not remarkably so.

On the 18th June they had each eaten a small round cell or hollow in the upper skin of the leaf close to the remains of the egg-shells, in the vicinity of which they still continued.

On the 19th they had eaten small deep holes,

piercing in some instances quite through the leaf, over the surface of which they were then more dispersed. Two or three other larvæ make their appearance on other leaves, but at this time their powers of locomotion were very feeble.

On the 20th their bodies appeared rather transparent, but with an internal, dingy, greenish, opaque, thick dorsal vessel showing through the skin. By the 27th they had grown double the size, with much the same colouring; shining, lightish warm brown heads, faintly purplish-brown bodies; black hairs on the back, paler ones below on the sides; the belly lighter than the back; a shining brown narrow plate on the second segment; the body less glistening and transparent than before. By the 8th of July the most advanced were two-tenths of an inch in length; the head and plate as before, but the body was more drab colour, with a darkish grey-brown dorsal line. They were now in their third moult, and increasing daily in size and in depth of colouring. The leaves of the plant were quite riddled with holes. By the 14th of July the colour was more of a drab like dingy-green, with pale brown head and small narrow plate on the second segment and a dark dorsal line.

At the next moult the larva becomes of a dingy-green and rather velvety looking, and measures when about to moult again nearly seven-sixteenths of an inch. By the 26th of July the ground colour was a dirty yellowish olive-green, with a dark purplish dorsal line showing faintly on the thoracic segments, but on all the others as a purple spot on the middle of each of them. The head light warm glossy brown, the hairs above black, those above the legs of a light drab. At this date one had already moulted again and attained a length of half an inch; the head still brown and shining, but the skin of the body no longer visible, being so densely clothed with light soft brown hair. On each segment on the back was a triangular mark of blackish-brown hairs, the base of the triangle

being at the end of each segment, and there was an undulating subdorsal line of similar blackish-brown hairs, and another, scarcely so dark, above the spiracles. The spiracles were of the brown ground colour, circular, finely ringed with black. A little below them was a fringe of bristly hairs, which were either cream coloured or very pale brown. Slight fascicles of longer black hairs diverged from each tubercle of the body; the head also bore a few blackish hairs. (W. B., Note-Book III, 266.)

#### THECLA RUBI.

#### Plate XIII, fig. 3.

The larva of this species had long been a desideratum to me, even after all the other British species of the genus, some of which are very much scarcer in the perfect state, had been duly figured. Perhaps the reason was that I and my friends tried to take it from the bramble only; but although diligent search was made for it on that plant in localities where the butterflies absolutely swarm, no one could find it for me; nor would butterflies shut up in a glass cylinder, with bramble buds and flowers, deposit their eggs on them. Doubtless the larva has been found on bramble buds, as Albin's account of it fully testifies, still I can now give two other food-plants for it, which I cannot help fancying are more to its taste.

On the 25th of June, 1868, Mr. W. H. Harwood, of Colchester, who had made acquaintance with the larva during the previous year, kindly sent me some fine full-grown examples, beaten from *broom*. I lost not a moment in depicting them, and no sooner were they done, than on the following day I received others from Mr. C. G. Barrett, then at Haslemere, he having, quite by accident, discovered them on *Genista tinctoria*, and most fortunately he was able to send me four in dif-

ferent stages of growth. These from the *Genista* were not so brilliant in markings as those from broom, but otherwise identical; and from both sets of larvæ the perfect insects came forth from the 25th of April to the 9th of May, 1869, very lovely specimens.

The full-grown larva is about five-eighths of an inch in length, and gains nearly an eighth of an inch when stretched out in walking; thick in proportion and somewhat onisciform in shape, flattened beneath; the head very small and retractile; the second and third segments rounded above; the others to the tenth inclusive have a dorsal hollow with an eminence on each side of it, which slopes thence to the lateral ridge; the last three segments are rather flattened above.

The ground colour is a bright yellowish olive-green, the hollow of the back is a darker full green, and down its centre runs the pale olive-green dorsal line, which gradually widens and suddenly contracts on each segment throughout its course, and becomes darker on the last three segments, and is there bordered by a yellowish stripe on each side; from each eminence on the other segments a thick bright yellow streak slants backwards and downwards, bounded beneath by an equally thick streak of deep full green, most intense at its beginning on each segment; the lateral ridge has a stripe of yellow, beginning at the third segment and running continuously round the anal extremity; parallel to this and above the spiracles is a faint indication of a stripe a little yellower than the ground colour. The head is pale brown with darker brown round the mouth; the appearance of the larva is velvety, caused by minute raised points bearing fine short bristles.

The larva, when younger, has the yellow markings less distinct, and in two of the examples found on the *Genista* they scarcely appeared even to the last.

The larva enters the earth, but only just beneath the surface, to undergo its change.

The pupa is very short and thick, especially about

the middle of the abdomen, rounded, and blunt at the anal tip; the wing-cases nowhere projecting, but smooth and large in proportion, and, like the rest of the surface, unpolished. In colour it is of a dark, dull purplish-brown, and it is thickly clothed with short dark-brown bristles, excepting only the wing-covers, which are blackish-brown and have no bristles. Its appearance would assimilate very well to pellets of earth. (W. B., E.M.M. VI, 38.)

#### CHRYSTOPHANUS PHLEAS.

##### Plate XIII, fig. 4.

On the 4th of July, 1876, I received from the Rev. J. Hellins a larva of *C. Phleas*, which he had reared to about the length of a quarter of an inch on *Rumex acetosa*. It continued to feed well on sorrel, and by the 10th of July had attained the dimensions of five-eighths of an inch in length, and was thick in proportion, somewhat onisciform, but without any dorsal ridges or hollows; the back curved, sloping on the sides and at each end where it tapers a little. The second segment is rather longer than the others and bilobed at its front margin, the sides dilated a little below the spiracular region; the segments very well defined by close and moderately deep divisions; the belly flat or rather hollow; the head very small and hidden beneath the projecting lobes of the second segment, as are all the legs beneath the body.

It is not easy to see the head even when the larva is crawling or feeding, as the bilobed anterior margin of the second segment projects so far over the head; the notch in the margin of the second segment seems well adapted to receive and steady the edge of a sorrel leaf whilst the larva is feeding.

In colour the head is pale brown, with a darker brown spot at the base of the papillæ, and just above

the mouth a thin streak of darker brown runs across ; the skin of the body is green and velvety, irrorated with minute flesh-coloured dots, each emitting a light brown, shortish fine bristle ; there is a faint appearance of a brownish dorsal line, the spiracles are flesh-coloured and tolerably distinct ; on the second segment is a flesh-coloured dorsal fine line, rather sunk between the lobes ; all the legs and prolegs are pinkish flesh colour.

On the 14th of July, after feeding well in the interval, it appeared to be full fed, and the next day took up its position under the lid of a tin box and then appeared somewhat shorter and thicker, more spherical in form, and on the 17th it was a pupa. On my lifting the lid, I saw the pupa lying at the bottom ; it had been fixed by a triple thread round the body behind the thorax, which had broken away from the pupa, being touched by the side of the box when the lid was removed.

I figured the pupa on the 24th of July. It was seven-sixteenths of an inch long, and a quarter of an inch in diameter in the thickest part of the abdomen ; it was very thick and dumpy in shape, much like a *Polyommatus (Lycaena)* ; the depression between the thorax and the abdomen is but slight ; the wing-cases are rather long, but not in the least projecting ; the abdomen turned down near the blunt tip ; all the parts about the head rounded off.

Its colour is light brown, very much freckled with darker brown, there is a blackish-brown freckled dorsal stripe, on which is a black dot on each segment of the abdomen ; the thorax is rather broadly margined with blackish, with a black dot at each side ; on each side of the abdomen are three rows of black dots, of which the middle row is the largest ; the oval spiracles are pale flesh colour with a row of small black dots between them ; the wing rays are pale brownish, with blackish freckles between them ; the leg- and antenna-cases covered with finer freckles ; the eye-covers black and glistening. The wing-cases and leg-cases are

smooth, but the thorax and abdomen are covered with a short bristly pile of pale flesh-colour, only visible with a strong lens. (W. B., Note-Book III, 118.)

On the 11th of August, 1876, I received from the Rev. J. Hellins seventeen eggs of this species laid with others most freely on *Rumex acetosella* by a female in captivity. The egg is a good size considering that of the butterfly, it is circular in shape, rather flattened, though convex, of a light cream colour, very coarsely reticulated with whitish raised net-work. These eggs became greyish on the 14th, and on the evening of the 15th three of them hatched, and the others the next day. The young larvæ were not at all onisciform; they had their small heads well in front of the second segment, the body thickest at the third, fourth, and fifth segments, from thence slightly tapering to the rounded anal end.

In colour they were rather a dingy pinkish green, with a darker dorsal vessel, just visible, and on each side of the back one row of fine and longish black hairs. The larva is sluggish, though it occasionally eats holes through the leaves, it more generally makes a little channel on the under surface just the width of its body, and about its length, so that the larva lies sunk in this channel about on a level with the surface of the leaf. It then either quits this to make another similar hollow in which to rest, or else it continues to lengthen the channel already made always keeping to the under surface of the leaf, eating the green cuticle there, which is much thicker than that on the upper surface of the leaf.

On the 21st the larvæ were very light greenish in tint, a little thicker than before; by the 24th they had all moulted, and were again a little thicker and more uniform in bulk than previously; the most forward individual one-eighth of an inch in length, already showed a distinct darker dorsal line, rather brownish on its light green skin; four other longitudinal faintly darker lines appeared on either side, and between

them small warty tubercles ; the hairs blackish, apparently more numerous than before ; the belly flattened. When this is seen by turning the larva over on its back, the head can only be seen as though sunk in a hood formed by the overlapping margin of the second segment.

By the 15th of September some had grown to be a quarter of an inch long, and two individuals were broadly marked with deep purplish rose-pink all round the lateral margin, the dorsal line was also of the same colour. (W. B., Note-Book III, 138.)

#### POLYOMMATUS (LYCENA) ARGIOLOUS.

##### Plate XIV, fig. 1.

In the spring of 1862 I had a few eggs laid by a captured female on the foot-stalks of flowers of holly (*Ilex aquifolium*) ; the larvæ hatched during the last two days of May, fed first on the flower-buds of the holly, and afterwards on the young green berries, and by June 29th, that is, in about thirty days, had changed to pupæ.

I had been anxious to work out the question of a second brood of this species, but as no butterfly ever appeared from any of these pupæ, my attempt at that time came to an unsuccessful end.

On the 20th of June, 1875, I received two full-grown larvæ, feeding on tender young leaves of holly ; they had been taken by beating, a day or two previously, by Mr. G. F. Mathew, R.N. ; one of them had already ceased to feed and had changed colour ; the other was still feeding well, and I watched it eating a large piece out of a freshly gathered tender leaf. The next day this also rapidly changed colour, and on June 25th and 26th, both successively became pupæ. One fixed with its head downwards on the upperside of a leaf, the other with its head upwards on the underside. From

the second of these two pupæ, after eighteen days, there came a female butterfly on July 14th; the first pupa remained over till May 25th, 1876, when it produced an ichneumon.\*

After this, on the 5th of August, 1875, I received from Mr. E. F. Bisshopp, of Ipswich, who had taken great pains to secure some female butterflies of the second or summer flight, a batch of seven or eight eggs, laid just beneath the flower heads of an umbel of ivy (*Hedera helix*); unfortunately, only two of them proved fertile, and I had the further misfortune to kill one of the larvæ whilst changing its food, but in the very same process was afterwards lucky enough to find compensation for its loss. For, early in September I found I had unconsciously gathered with a head of ivy flower buds, resting on one of the flower stalks, a larva in its third moult; and being thus led to look for more, I afterwards found two others in similar situations.

The dates for the changes of the larva, which I succeeded in carrying through from the egg, and which, from the first, ate tender ivy leaves rather than flowers, are as follows: hatched August 8th; moulted by the 12th, a second time by the 16th, and a third time by the 20th; after that I have recorded a moult between September 1st and 5th; by the 10th it was mature, on the 13th it fixed itself for changing, and on the 17th became a pupa; thus passing just forty days in the larva state; the butterfly, a male, appeared on the 6th April, 1876 (202 days having been passed in the pupa state), but perhaps its emergence had been somewhat hastened by its being kept sheltered indoors.

In a general way, therefore, the year's history may be divided as follows: the first flight of the butterflies is at the end of April and in May; the larvæ from these are hatched at the end of May, and feed on holly

\* Unfortunately this ichneumon got damaged before the Rev. T. A. Marshall saw it; hence, though he was able to refer it to the genus *Limneria*, he was not able to identify the species.

flowers and young leaves, or on young ivy leaves through June (Mr. Harwood of Colchester informs me that he has also found them on the flowers of *Rhamnus frangula*) ; the second flight of butterflies is in July ;\* the second brood of larvæ feed in August and September on the flower buds and young leaves of ivy ; the winter is passed in the pupa state.

The egg of *Argiolus* is very much like that of *Alexis*, except that it is rather larger, being circular, flattened, and rather depressed in the centre ; the whole surface —except just a central spot—is overlaid with raised reticulation, with little knobs at the angles ; the shell is pale bluish-green, with the raised reticulation whitish. The larva escapes by making a hole near the centre of the upper surface.

The young larva in the spring is something like that of a *Zygæna* in shape, plump and hairy (as was noticed both by Mr. Hellins and myself), even while quitting the egg-shell, with a greenish-white body and dark head and very slow in its movements ; but the summer larva I found for the first few hours to be very active, walking about with almost a looping progression, and much more slender than that of any *Polyommatus (Lycaena)* at present observed.† The head moderately large, rough and prominent, of a chocolate-brown colour ; the body shining, very pale translucent-greenish, and apparently naked. Looking at this unusual form for a newly hatched *Lycaena* larva, one tried to account for it from the heat of the weather, and by thinking it was better fitted to pierce the hard buds of the ivy just formed, than if it were at first more the shape of its congeners.

\* [Or August.—H. T. S.]

† Knowing the very great care and attention which were used by Mr. Buckler in his studies of growing larvæ, I feel a certain amount of hesitation in saying that I think he here made a mistake. This account of the young summer larva was drawn up from one example, and I believe this must have been the larva of some *Tortrix* introduced with the food. Subsequent investigations, as shown in the text, failed to discover any difference between the newly-hatched larvæ of the two broods of *Argiolus*, although when this was pointed out to Mr. Buckler his confidence in the observation he had recorded remained unshaken.—J. H., 28, 7, 85.]

After the first moult, it became stouter in figure, pale ochreous-green in colour, and clothed with unusually long, whitish, soft, silky hairs, and was very sluggish, no longer differing from larvæ of the spring brood.

When about a fortnight old, it attains the length of three-sixteenths of an inch, and becomes of the usual *Lycæna* shape, with smooth glistening skin and with the colour similar to that of the young ivy buds; in about three weeks it is five-sixteenths of an inch long and stout in proportion, showing a paler streak on the ridges of the back, thin double slanting lines on the sides, and a margin of yellowish-white along the sub-spiracular region.

In about five weeks it is full fed, and then reaches the length of three-eighths of an inch, and sometimes more when stretched out in crawling; the figure somewhat onisciform; the head very small and retractile into the second segment beneath; the second segment, which is the longest, is but slightly convex above, the others are arched on the back, the third, fourth and fifth being the highest, and thence the others slope a very little to the tenth. These eight segments (from the third to the tenth inclusive) are crested with two ridges of humps, between which lies the sunk dorsal space, broad and hollow on the third and fourth, and flattened and narrowing gradually to the tenth; on these segments the divisions are deeply cleft through the ridges, thus producing the appearance of humps; segments eleven, twelve, and thirteen are simply convex, and slope towards the anal end; the sides although sloping outwards, become almost concave near the projecting rounded sub-spiracular ridge, which continues round the anal segment, overlapping all the short prolegs. The belly is flattened.

In colour there seem to be several varieties; one, a bright yellowish-green, with paler lines as above, the head purplish-brown, but looking almost black by contrast, and with an ochreous streak above the mouth and at the base of the papillæ, the spiracles round and

flesh-coloured, the whole skin of the body velvety, with its surface thickly covered with yellowish warty granules, each bearing a minute bristly white hair.

Another variety, of the same yellowish-green ground colour, has dashes of deep rose-pink on each humped ridge of the back and in the dorsal channel continued to the anal end, and an additional dash on each side of the fifth segment; along the sides, fine double lines of pale greenish-yellow, edged with darker, slanting backwards; the sub-spiracular ridge itself of a whitish-flesh colour, but deepening above and below with a narrow border of full rose-pink, which again melts into the green ground.

Another variation, which from the too rapid development of the example exhibiting it, was but imperfectly noted, is of a very pretty mixture of green and black; the ground colour green as before, a transverse bar of black across the middle of the second and beginning of the third segments, a dorsal series of thick dashes from the third to the tenth; the eleventh with a dash on either side enclosing the green ground as an interruption, with the dorsal marking again occurring on the twelfth and thirteenth segments; on each ridge of the back is a row of roundish spots, and a little lower on the side, a row of squarish spots and lower again, in the spiracular region is a row of roundish spots placed at the segmental divisions; on the fifth segment, the upper markings are thicker and run together.

About four or five days before changing the larva ceases to feed, becomes of a dingy olivaceous-pink or mouse colour, and spins a fine layer of silk as a foot-hold and a stout thread as a cincture, crossing the front of the third segment, and strengthened near the base on either side by two other short threads joining it, thus forming triple moorings.

In each instance I found the operation of changing to a pupa had brought the cincture away from its resting place on the larva to below the thorax of the pupa, so that this thread, at first slanting forwards

from the base over the larva, slanted now a little backwards over the pupa.

The pupa is about five-sixteenths of an inch in length, and three-sixteenths in width, of a dumpy figure, thickest at the middle of the abdomen, with the head and thorax rounded, and the latter very slightly keeled ; a depression occurs between the thorax and abdomen, where the cincture passes which holds it secure ; thence the abdomen swells out full and arched towards the bluntly rounded anal end ; the wing-covers are long in proportion, but not at all projecting.

In colour it is pale brownish-ochreous, with a blackish-brown thin dorsal line marking the thoracic keel, and on the abdomen a series of rather blotchy arrow-head dorsal dashes, and a subdorsal series of larger dark brown blotches, that nearest the thorax being the more conspicuous from the next segment being without one. The thorax is marked with oblique rows of brown freckles directed from the sides of the head towards the end of the keel at the depression ; the eye-covers are blackish, the wing-covers pale greyish with rays of brown freckles, and outlined with a thin brown edging, their surface smooth, rather more glistening than the other parts, which are thickly studded with fine, short, brownish bristles.

It may be worth mentioning that during the month of May, 1876, eggs were laid by a female *Argiolus*, in captivity, on holly and also on young shoots of ivy, and that both Mr. Hellins and I find that the larvæ eating ivy are more advanced than those feeding on holly. (W. B., 12, 6, 76 ; E.M.M. XIII, 29.)

Since the above was written some further variations of the larva may be mentioned ; they occurred amongst a recent brood, reared from eggs, which were brought successfully through to the pupa state, both by Mr. Hellins and myself.

Several individuals were olive-green, strongly marked with crimson on the dorsal region and along the sides, and deeply suffused with this colour on the thoracic

segments, while in the midst of this suffusion there appeared a pale yellowish-olive semi-lunar patch, situated transversely on the back at the hinder part of the second segment.

Another variety was coloured with deep rose-pink on the three thoracic and the last three segments, while the middle segments of the body were light green.

The plain green varieties included individuals of greenish-yellow and others of olive-green.

Some further enlightenment as regards the food of this species has been given me by Mr. G. F. Mathew, R.N., who kindly informed me that on the 22nd of last June some flowers of *Escallonia* were brought to him to look at, when on one of them was detected a larva of *Argiolus*, about a quarter grown.

No doubt other food will also be found to have nourished this species, and thus a good deal of the old puzzle as to the appearance of the butterfly in localities where no holly grew is done away with. (W. B., 7, 76; E.M.M. XIII, 62.)

It may be interesting to mention that during last month (August, 1876) Mr. Hellins obtained a number of eggs of *Argiolus*, and sent a portion of them to me, and that all the larvæ on hatching were found to be exactly like those of the spring brood, in being furnished with hairs and in moving slowly. (W. B., 22, 9, 76; E.M.M. XIII 138.)

#### POLYOMMATUS (LYCÆNA) ALSUS.

#### Plate XIV, fig. 2.

The observations made by Mr. J. Gedge ('Entomologist's Monthly Magazine,' vol. iii, p. 205), that the female of this butterfly deposits her eggs on the heads of *Anthyllis vulneraria* had for some time been tempting Mr. Buckler and myself to try and rear it from the egg, and we have now succeeded in rearing the larvæ to their full size.

I received several specimens of the butterfly, which had been captured by Mr. Buckler in Hampshire about June 15th, 1870. I placed them on a plant of *Anthyllis vulneraria* in a large cylinder, and although they died off rapidly, one female at least survived to lay about a dozen eggs between the 16th and 18th of June. The larvæ began to hatch on the 21st, and at once took to the flowers of *Anthyllis*, either eating a hole through the downy calyx, and then through the corolla to the immature seed-vessel, or else beginning by eating the lip of the corolla, and then going down to the base of the style.

From first to last the seed certainly was the part preferred, and whilst the larvæ were small they fed on it hidden within the corolla; when they had attained some size they pierced the side of the calyx and corolla, and thrust in the forepart of their bodies to get at the seed-pod with its single seed, leaving their hinder parts outside, but still well hidden among the dense bunch of flowers which formed each head.

By July 1st they were barely half-grown, but in the next fortnight they developed rapidly, some of them by the 13th having attained the length of a quarter of an inch, and soon after this the most advanced were full-grown; others, captured in the locality from which the imagos came, were not so far advanced, but most of these also had ceased feeding by the end of July; they then placed themselves about on the gauze covers of their cages, or on the underside of anything in the cages that would hide them, and we expected to see them change to pupæ. However, up to the date of writing this (November 9th, 1870) no such change had taken place, but those larvæ which have not died are waiting on quietly, and I suppose will not now turn to pupæ till spring.

The egg seemed generally to be deposited low down on the calyx of the *Anthyllis* flowers, and though thus hidden from casual observation, it may be easily detected on a careful search; it is, as might be expected,

very small, shaped like the eggs of its congeners, that is, round, but more flattened than globular, with a central depression on the upper surface; this depression is the only place in which the pale green ground colour of the egg can be well seen, because the rest of it is closely covered by a raised white network of rhomboidal meshes, which, when viewed in profile are seen to stand out boldly from the shell.

The larva escapes by an irregular hole in the middle of the upper surface of the egg, and is a mite of a fellow to look at, dirty whitish-green in colour, with a little black head, a dark place on the second segment, and the tubercles bearing longish hairs; after a day or two the colour becomes somewhat reddish, and at the end of a week pale brown, with browner dorsal and subdorsal lines. After this there begins to be a little variation in colour in different individuals, some being more of a pinkish-brown, others more of a chocolate colour, the distinct dorsal stripe being of a deeper tint than the ground colour, and commencing as a broad triangular mark on the third segment and becoming gradually narrower up to the eleventh, where it widens out into a lozenge shape, contracting again to a narrow stripe on the twelfth and thirteenth; the tubercles show paler than the rest of the ground, because the brown hairs on them being divergent allow more of the paler skin to be seen.

Just below the second row of tubercles comes the subdorsal line, which in fact is composed of a series of dark brown dashes, one on each segment sloping backwards and downwards so as to let the tubercle stand out in high relief; along the edge of the lateral ridge runs a whitish stripe, which is continued round the anal extremity; the belly and legs of the same colour as the back.

The whole skin is studded with short bristles of a dark brown colour; the head is black and polished, but with a streak above the mouth, and also the base of the papillæ, yellow.

After this there is no change of appearance, save that of growing paler and more unicolorous (perhaps, as the bulk increases, more of the paler skin shows between the dark bristles), until some specimens are of an ordinary flesh-tint, and others of a brownish flesh-colour, and at this point the larvæ assimilate well with the changing colour of the corolla of their food-plant. After they cease feeding they turn off to a faint greenish-yellow.

When full-grown the larva is about one-third of an inch long, and may be roughly compared to a moderately sized grain of wheat cut in half, the back being arched in a curve and the belly flat with the legs placed well under it. Or it may be compared to a very tiny tortoise, the head being very small and retractile, and a lateral ridge running all round, and giving the appearance of an upper shell. The second segment is the longest and has a sort of triangular plate on its middle, and the last three segments are slightly depressed. The inner rows of dorsal tubercles are rather projecting, and thus form between them a sort of dorsal hollow; the second row I have already mentioned as affecting the subdorsal line. (J. H., 9, 11, 70; E.M.M. VII, 186.)

On the 5th of June, 1873, I received from the Rev. J. Hellins a pupa of this species. The larva with several others of its kind had been full fed in July, 1872, and soon afterwards Mr. Hellins had reported they were beginning to hibernate; the change to the pupa state not taking place until June 3rd, 1873!

This pupa, which I figured, was three and a half lines in length and one and a half lines in diameter, moderately plump in appearance, the head and thorax well defined, the tip of the abdomen blunt and rounded. When viewed in front its general form is that of a narrow ellipse, but when seen sideways the prominent swelling of the thorax and the tip of the abdomen bent under, with the long wing-cases give the usual appearance of the pupæ of this genus.

It was neither suspended by the tail nor had it any silken cincture, and it might very well be passed over as a stony particle on the chalky soil of its *habitat* on Portsdown Hill.

The colour of the pupa is dirty whitish-grey approaching to drab, palest on the back of the abdomen, greyish on the head and thorax, both of which are marked with a black dorsal stripe, which is a little interrupted; on either side is a subdorsal row of short slanting black dashes. The pale ground colour is sprinkled with some very minute black specks. The wing-nervures are well defined by the spaces between them being filled up with dark grey. The head, thorax, and abdomen are hairy with bristly whitish hairs, of which there are none on the wing-, leg-, and antennae-cases.

The butterfly made its appearance June 24th, 1873, at 10 o'clock in the morning. (W. B., Note-Book II, 12.)

The whole year's history of this species comes to this :  
Egg laid about the middle of June.

Larva hatched within a week ; full fed and fixed motionless about the end of July. So continuing for ten months till the beginning of *next June*.

Pupa state then lasting for some two or three weeks, and the

Imago living but a short time to perpetuate the species.

The long continuance in the larva state after being full fed seems very remarkable. (J. H., 14, 6, 73 ; E.M.M. X, 43.)

## POLYOMMATUS (LYCENA) ARION.

(One of the few larvæ of which there is no figure in this volume.)

On the 15th of June, 1869, I had the great pleasure to receive from Mr. Herbert Marsden, a ♂ and ♀ *Polyommatus (Lycaena) Arion* alive; they had been captured by him together; he also sent me at the same time two small plants of *Thymus serpyllum* in blossom.

These plants were potted separately and the insects put on one of them under a glass cylinder. During a gleam of sunshine the ♀ certainly appeared to me to deposit an egg among the flowers, but the weather being cold and cloudy I deferred further observation until the following day, when I again saw her deposit an egg as before.

After dark I removed the butterflies to the second plant in order that I might closely inspect the first on which they had been for two days; nor was I disappointed, for on the morning of the 17th, on looking over the blossoms with a strong lens, I detected six eggs, all laid on the calyces between the heads of the flowers, but not one on either stalk, stem or leaf.

The egg of *Arion* is round, smooth, and depressed on the top, pale greenish-blue in colour. Although the eggs hatched both with Mr. Merrin and myself, yet we have failed to detect the young larvæ on the plants at present, but we believe they must be very small, hiding away somewhere, and that they will most likely hibernate. (W. B., 13, 8, 69; E.M.M. VI, 91.)

On the 15th of June, 1870, I received a pair of these butterflies captured *in cop.* by Mr. Merrin, junr., and kindly sent me by his father. They were at once placed on *Thymus serpyllum*, and on the 17th were removed to another plant of thyme; the male was then dead. I now counted the eggs and found six-

teen, a few being laid on the stems and others on the corolla of the flowers. No doubt there were more eggs which I did not at the time detect.

These eggs hatched on Thursday night, the 23rd of June, *i.e.* on the seventh or eighth day after they were laid, but I could not detect the young larvæ. After a careful inspection of the plants I telegraphed to Mr. Hellins, to whom I had previously sent eleven eggs, and his reply informed me that his were hatched and that he could see one larva feeding.

During the following week he reported them to be looking like very small pinkish-brown maggots. . . .

On the 17th of June, 1870, I received from Mr. Herbert Marsden a pair of *Lycæna Arion*, said to have been taken *in cop.* They were placed directly on *Thymus serpyllum*, and the female laid nearly a dozen eggs, but they proved to be infertile and soon shrivelled up.

Another female kindly sent me by Mr. Marsden on the 20th June, 1870, yielded no egg and died the following day. (W. B., Note-Book II, 187.)

#### POLYOMMATUS (LYCÆNA) ADONIS.

##### Plate XV, fig. 1.

On the 30th of August, 1873, Mr. A. H. Jones most kindly sent me two living females of this species which he had just captured at Folkestone. These I placed at once under gauze on a plant of *Hippocrepis comosa*, and during the three or four days they remained alive they laid about twenty eggs. The larvæ I believe hatched towards the end of September, but as I kept them on a growing plant out of doors, I could not see them hatching. In October I found the leaflets of the vetch marked with little whitish dots; these were caused by the larvæ tunnelling into the underside, and eating out the inner surface for a small space, leaving the upper skin untouched, which then turned white.



I kept their cage in a garden-frame without bottom heat, but in a warm situation, and thus sheltered them through the winter, and on sunny days the larvæ could be seen enjoying the heat, stretched out—if that term may be applied to such diminutive dumpy creatures—along the midrib on the upper side of a leaflet. Up to December they remained less than one-sixteenth of an inch in length, but in January, 1874, some were grown to nearly one-twelfth of an inch, and were not only marking the leaflets with larger blotches, but were also beginning to nibble their edges.

About the middle of March I noticed that they had increased somewhat in length, and considerably in stoutness, and that they were now eating the leaflets in the usual way; and by April 1st they were quite one-eighth of an inch long, and could eat a whole leaflet at a meal. Through this month they grew rapidly, the warm weather suiting them well, and they ate voraciously, till, by the 30th, several of the most advanced in growth had hidden themselves under the loose soil for pupation. After waiting eight or ten days they changed, and finally the butterflies came out between June 2nd and 15th.

Mr. H. Terry, of St. Marychurch, Torquay, informs me that he finds the first flight of *Adonis* on the wing by May 20th, and the second about the middle of August; the two broods, therefore, taking respectively nine and three months out of the twelve to complete all their transformations.

The egg of *Adonis* resembles those of its congeners, being small, round, and flattened in figure, the shell covered with raised reticulation, having prominent knobs at the angles; the central portion of the upper surface looks sunk, being covered with finer reticulation with no knobs. The colour is a light dull grey, the reticulation and knobs white.

The larva escapes through an irregular and rather large hole in the upper surface of the egg, and the empty eggshell looks whitish; the young larva is pale

whitish-green, soon becoming a full but dull green; all the warts furnished with hairs which produce a downy appearance. During the winter months the green is replaced by reddish-brown, and again in the early spring the larva becomes pale purplish-brown, with the dorsal humps and the subspiracular ridge showing pale ochreous-brown. After a moult, about the end of March, the dull greenish hue comes back, the paler marks becoming yellowish, and the hairs black.

The full-grown larva is about five-eighths of an inch long, and a quarter of an inch wide, onisciform, with the head small and retractile beneath the second segment; the segments deeply divided. There is a double dorsal row of eight humps or segments three to ten inclusive, enclosing a slightly hollow space, which is broadest on three, and thence tapers gradually to ten; the side spreads out to a rounded ridge running round the body, and hiding the legs from view when the larva is at rest.

In colour, the head is very dark brown; the body is *deep full green*, covered with tiny black specks, bearing little *black bristles*, which are longest on the dorsal humps and sub-spiracular ridge; on the top of each of the eight pairs of dorsal humps is a deep bright yellow longitudinal dash, somewhat wider behind than in front; these dashes form in effect two yellow stripes interrupted by the deeply sunk segmental divisions; along the rounded edge of the sub-spiracular ridge is a stripe of bright and very deep yellow going all round, save a slight interruption on the sides of the second segment; on the second are two yellow dots just above the head, and above them again two small black spots; on the third there is a very faint yellowish dot half way between the dorsal and sub-spiracular stripes; just above the feet is a row of yellow longitudinal dashes, brightest on the feet-bearing segments, and in one example these dashes were curved upwards, and united at the end of each segment to the yellow

ridge above. In some specimens the ventral prolegs are also marked with yellow; the spiracles are conspicuous, being round and black; the pulsating dorsal vessel is rather deeper green than the ground colour.

Some of my larvæ buried themselves about half an inch deep in the loose soil, and formed a weak sort of cocoon; others, not having been supplied with soil that could be easily penetrated, retired under the stems of their food-plants, and in angles formed by the branching stems spun a few weak threads to keep themselves in place.

The pupa is barely half an inch long, dumpy in figure; the profile of the back swells out at the thorax, drops in again at the waist, and the abdomen slopes off in a curve to the rounded anal end; the ventral profile is much straighter, though still with a slight curve; the wing-cases reach more than two-thirds of the whole length, and the widest part is just where they end. The thorax and wing-cases are slightly glossy, the abdomen granulated; there are some very small hairs scattered all over; the colour is at first greenish on the wing-cases, greenish-brown on the rest of the body; afterwards ochreous all over, and finally turning very dark the day before the imago emerges.

On comparing the larvæ of *Adonis*, which I had sent him, with figures of *Corydon* made some years ago, Mr. Buckler could detect no point of difference except a somewhat different tint in the green ground colour; this made us very anxious to see the larva of *Corydon* again, and our wish was very soon gratified in an unexpected manner.

My friend had sent me a great many plants of *Hippocratea comosa* for my larvæ, and upon one of these that had not been wanted for their use, I found on June 8th, a half-grown *Lycæna* larva, which had evidently travelled to me out of Hampshire with its food.

I had been told that *Corydon* occurred at the place whence the plants were procured, but not *Adonis*, yet

this larva was so like those I had lately reared that I felt quite puzzled. It luckily happened that Mr. Buckler and I had just been comparing the notes we had made of *Adonis*, and so, seeing in this larva all that I had seen in *Adonis*, except that its bristles were brown instead of black, I sent it on to him at once, drawing his attention to a little point which I had wished him to notice in *Adonis*. Thus with every incentive to exactness, he examined and figured it most carefully, finding nothing to notice but the tint of the ground colour and the hue of its hairs, and then kept it apart, waiting to see what the imago would prove to be, till on the 31st of July there appeared a fine *Corydon*.

As far, therefore, as our means of comparison have gone—our materials to work upon being some dozen and a half larvæ of *Adonis* on the one hand, and this one larva of *Corydon*, and figures of others taken in 1862 on the other—we can say that the two species resemble each other in the larval state in every particular of form and ornamentation except these two points :

*Adonis* has its *ground colour deeper green*, with the *hairs or bristles black*, while *Corydon* has the *ground colour of a lighter, brighter green* (a green with more yellow in its composition), and the *hairs light brown*.

I have been thus minutely circumstantial in relating what was done by us because the result we have arrived at is not altogether in agreement with what we have been able to find already published. Thus, in ‘Stainton’s Manual’ there are descriptions from Freyer, which, according to our observations, rightly distinguished between the *green* of *Corydon* and the *deep green* of *Adonis*, but err in making the number of yellow dorsal streaks different, for *Adonis* certainly has but eight in a row, and not twelve.

The only other author accessible to us, Boisduval, speaks of “le grand rapport qu’il y a entre cette chenille (*Corydon*) et celle d’*Adonis*,” and gives every

point of figure and marking as identical, but goes on to say that *Adonis* "est d'un vert très pâle un peu jaimâtre," and calls its "tubercles" not black but "bruns;" while *Corydon* "se distinguerá toujours assez facilement au premier coup d'œil par sa couleur d'un vert foncé, et par la petitesse de ses stigmates ;" yet this is directly contrary to what we saw in our examples, viz. the deep green in *Adonis*, and the yellowish-green in *Corydon*, and the spiracles of the same size and form in both. (J. H., 11, 8, 74; E.M.M. XI, 113.)

## POLYOMMATUS (LYCÆNA) ALEXIS.

## Plate XV, fig. 2.

On the 7th of September, 1880, near the shore, I dug up a small plant of *Lotus corniculatus*, and potted it the same evening. The next day I observed a couple of empty egg-shells of a *Lycæna* on the plant, one appearing quite fresh as though the young larva had only just left it. The hole at the top by which the larva had made its exit seemed wet and darkish green. The exterior of the shell was very rough with projections, and precisely similar to the egg of *Ægon*, and of the same round-flattened shape, its colour of a very faint greenish-white.

Two days later, on the 9th, I detected the little larva on an adjoining leaf on the upper surface, a few grains of black "frass" having guided my eye to detect its presence. The larva matched well with the dull bluish-green leaf, it was of a sausage-like form, and a strong lens enabled me to discern two rows of minute black dots down the back. Its mode of feeding on the cuticle of the leaf caused little pale transparent blotches to appear, and I could see from these indications that it had been on other leaflets adjoining.

Towards the evening of the 11th I lost sight of it, and did not again see it till the afternoon of the 18th. It was then close by the side of the egg-shell, having moulted whilst out of sight. It was much grown, and appeared of rather a pinkish colour, and was hairy. I soon afterwards planted in the same pot a root of *Ornithopus perpusillus*.

On the 18th of March, 1881, I saw that the larva had been making transparent blotches on the *Lotus*, and also on the leaves of the *Ornithopus*. Under the leaves of the latter plant I soon detected the little fellow; it had grown considerably, and was nearly a quarter of an inch long. It was of a green colour beneath, but much tinged with purplish pink on the sides, and especially on the back. The paler sub-dorsal and spiracular lines were plainly visible, proving it to be the larva of *Alexis*.

A week later I could not find it, the *Lotus corniculatus* had died, and the larva must have made its escape. (W. B., Note-Book IV, 47.)

#### POLYOMMATUS (LYCÆNA) ÆGON.

##### Plate XV, fig. 3.

On the 31st July, 1867, Mr. C. G. Barrett, then at Haslemere, most kindly sent to Mr. Hellins and myself some eggs of *Ægon*, which, by an ingenious contrivance he had induced a ♀ to deposit on twigs of heather.

Being in doubt as to the proper time for their hatching I kept those I had in an ordinary room for daily inspection until the approach of winter.

On the 23rd of February, 1868, Mr. S. Hudson obligingly forwarded me three eggs, part of a small batch he had obtained from a ♀ during the previous summer near Epworth, accompanied by the welcome intelligence that he had satisfied himself by experi-

ment that the larvæ were alive and stirring within the shells, and that he expected them shortly to hatch.

I immediately removed all I had to a cooler place than they had previously been in, so as to retard their progress until something could be learned about their proper food.

Considering the small size of the butterfly the egg is rather large in proportion. It is white in colour, of a circular form, flattened and depressed in the centre both above and below, covered with raised white reticulation, all except the top.

The egg does not change colour, but retains its pure dead-white appearance even after the exit of the larva; a small hole showing like a black spot on the side of the shell alone betraying the escape of the little creature.

Mr. Hudson informed me of one of his larvæ being hatched on the 29th February, which was followed by others on the 3rd of March. All were placed on various little plants from the locality where the parent butterfly had been taken, but from want of the right food and partly by accidents they were starved or lost.

On the 28th February Mr. Hellins reported that one larva had hatched, and that it soon after died; and another on the 6th March, which was placed on heather, *Lotus corniculatus*, and one or two other vetches, but with no success.

On the 18th of March two of my eggs hatched, and the larvæ were placed with a variety of food, but they died without eating, and others soon followed in the same way, with Mr. Hellins and myself. Shortly afterwards, however, Mr. Hellins acquainted me with the fact of his having distinctly seen one eat a tiny hole in the leaflet of a small vetch, *Ervum tetraspermum*, growing in his garden, and he sent me one of the plants, and upon this for some days the larvæ as they were hatched were placed; but instead of

eating they wandered away, or fell off on to the earth below, where it was impossible to find them.

Meanwhile we had not been idle in ventilating the subject among our friends, in what seemed a forlorn hope of obtaining a clue to the proper food-plant, when fortunately at this critical juncture, Mr. Double-day kindly gave us the benefit of his excellent memory and observation, in recalling the fact of his having seen, twenty years ago, this little butterfly in some place flitting over *Genista anglica* and *Ornithopus perpusillus*, and that on the latter plant he had noticed females alight.

In the midst of my trouble at losing the young larvæ daily, and being unable to find the desired *Ornithopus*, I fortunately happened to mention the subject to Dr. F. B. White, of Perth, and he with great good nature and promptitude despatched me a tin full of the plants. These were at once potted and sprinkled with water, the remaining six or seven eggs put on them in a sunny window, and in a day or two, by aid of a lens, the young larvæ were soon detected. By the 3rd of May some small transparent blotches were visible on the leaflets on which they had fed, and from that time all went well; after Mr. Hudson's attention had been directed to *Ornithopus perpusillus*, he satisfied himself that in his locality the butterfly did not occur away from that plant; so it seems there is little doubt of its being the natural food.

When first hatched the larva was about three-fourths of a line long, thick in proportion, of equal bulk, and rounded at either end, hairy and of a dull bluish-green colour, its powers of locomotion of the very feeblest description.

By the 3rd of May they had become rather more than a line in length, of a drab colour, and hairy like the leaflets on which they were feeding. By the 29th of May they were from a quarter to three-eighths of an inch in length, but still did not eat through the leaflets, but only devoured the green cuticle. At this

time they were of a deep yellowish-grey, and the dorsal stripe blackish-olive edged with whitish, and a whitish line along the lateral ridge above the legs; the subdorsal stripe was triple, consisting of two lines of blackish-olive with a whitish-grey one between them. The surface generally studded with minute blackish points, each bearing a fine short hair.

By June 11th to 15th they had all assumed their last coats.

The full-grown larva is about seven lines long, thick in proportion, and of the usual onisciform or *Lycæna*-shape.

The head small, and retracted when at rest or alarmed; the second segment the longest, rounded, and very slightly flattened above, the others as far as the tenth with raised prominences on each side of the back, and a dorsal hollow between them; the sides sloping to the lateral ridge, the ventral surface rather flattened, the legs all placed well underneath. The last three segments without dorsal ridges, and sloping gradually to the sides and anal extremity, their sides rather concave, a very prominent wart on each side of the twelfth; the segmental divisions not observable on these last, but well cut on all the others.

In colour the larva is now a bright yellow-green, with the dorsal stripe blackish-brown edged with whitish from the beginning of the third to the end of the tenth segment; it is widest on the third and fourth, being on them of a rather rounded lozenge form, with a whitish dot near the edge on each side; a dull dark-brown small plate in front of the second segment, and a broad semilunar shaped blotch of the same colour a little behind, divided in the middle by a fine line of the green ground-colour. The dorsal stripe on the eleventh segment becomes broad and squarish, but resumes its linear shape on the twelfth and thirteenth.

The subdorsal line is visible from the beginning of the third to the end of the eleventh segment as a

greenish-yellow line running between two green ones darker than the ground colour.

At the bottom of the sides along the lateral ridge is a whitish line commencing on the third segment and continued round the anal extremity. Between the dorsal and subdorsal lines on segments three to ten are faintly paler oblique lines of yellow-green, viz. one on each segment sloping downwards and backwards; the warts on the twelfth segment are very often suddenly projected considerably, and then a circle of fine short hairs is visible on their extremities. The surface of the body is also clothed with similar hairs. The head is black, having the base of the papillæ and a streak across above the mouth of buff colour.

They had all turned to pupæ by the 24th of June, one of them being slightly attached to a stem of the plant by the anal extremity, and lying, like the others, amongst a few loose threads at the very bottom of the stems and partly in the earth.

The pupa is about five lines long, smooth, but without polish, the top of the head slightly projecting, the thorax rounded, the abdomen plump, curving on the back outwards and backwards towards the tip, which is hidden in the larva skin, the wing-cases prominent and long in proportion. It is of a dull green tint, with a dark brown dorsal line of arrow-head marks.

The butterflies appeared July 5th to 17th. (W. B., 2, 69; E.M.M. V, 241.)

#### POLYOMMATUS (LYCÆNA) AGESTIS (*MEDON*).

Plate XVI, fig. 1 (1, 1a, 1f).

When Professor Zeller in 1867 published his most interesting history of this species in the 'Entomologist's Monthly Magazine' (vol. iv, pp. 73-77), he stated it to be generally accepted that *Lycæna Artaxerxes* is only a variety of *Medon*, Hufnagel (*Agestis*, Ochs.); and yet it appeared to him extremely impro-

bable that the larva of *Medon* should habituate itself to the food-plant of *Artaxerxes*.

I am now able to offer the following evidence that the larva of this species really does nourish itself on the same species of food-plant in England as in Scotland.

On the 3rd June, 1877, Mr. J. E. Robson, of Hartlepool, while searching *Helianthemum vulgare* growing near the coast in his locality, found five larvæ of a *Lycæna*, and at once very kindly forwarded them to me; on comparing them with the figures I had taken of larvæ of *Artaxerxes* in 1868, I found them to be in every respect precisely alike. These larvæ soon fed upon *Helianthemum*, protected by a glass cylinder, and they duly changed to pupæ; two of them were unfortunately attacked with mould, but the other three disclosed three differently marked butterflies, viz. on July 2nd, 5th, and 7th. These appeared to be respectively *Salmacis*, *Artaxerxes*, and *Agestis* above, but to partake most of *Salmacis* beneath.

After this result, I became more than ever desirous of seeing larvæ of the typical *Agestis* from the southern downs, and it was not many weeks before Mr. Wm. R. Jeffrey most kindly put me in the way of making their acquaintance from the egg onwards, by his capturing several typical females as they were flying over and alighting upon *Helianthemum vulgare*, on a Kentish chalk down. They readily deposited their eggs on sprays of the plant, and I had the pleasure to receive a share of them from my friend on the 13th of September, when I found them all laid on the undersides of the leaves to which they firmly adhered, singly, and in little groups of twos, threes, or more together.

The egg is smaller than that of *Aegon*, though very like it in form and sculpture, being circular, flattened, with a central depression on the upper surface, the shell covered with a coarse, prominent reticulation, gradually becoming finer towards the nearly smooth

depression ; its colour, a pale greenish-drab, continues to the last. A hole in the shell betrays the escape of the larva, which is a very sluggish little creature, not inclined to leave the underside of the leaf where it is hatched, even when the leaf has become dry ; indeed, all the leaves on which the eggs were laid had curled and shrivelled so much when the larva were hatched, as to make their detection and rescue while alive rather difficult.

I observed the first three larvæ on the 19th of September, one of them already dead, and on the 22nd, eighteen more, with some of them apparently dead or dying.

A month previously I was provided with a very large pot of turf cut from a chalk hill, and amongst grasses, *Leguminosæ*, and other low plants, some fine shoots of *Helianthemum vulgare* were also growing ; on these last the young larvæ were placed. Next morning, about half of them lay dead, and the others had disappeared. But after a day or two I began to detect signs of the survivors, by small flesh-coloured spots appearing on the upper dark green surface of a few of the leaves ; these spots gradually increased in size to blotches of irregular figure, and turned of a rusty pale brown colour ; when seen from beneath against the light, they appeared semitransparent and colourless, and sometimes then the tiny larvæ appeared as a dark object against the luminous blotch.

By the 20th of October a few leaves had their lower cuticle almost entirely eaten away, and their upper surface turned brown, but so slow was the growth of the larvæ that they had only attained one line in length by the 3rd of November, and though they fed a little at intervals, and crept from one part of their food to another up to the end of the month, yet they were never seen on any of the other plants around them, but only on the under surface of the leaves of *Helianthemum*, where they became eventually fixed for hibernation.

The pot containing the larvæ and the various plants was kept entirely uncovered inside a window of western aspect; the grasses were much grown by the 7th of March, 1878, when I could only see two larvæ on a new shoot of their food, and on the 14th only one, whereupon I began to cut down the grass (a blade at a time) carefully, so as to lay bare the few new scattered shoots of *Helianthemum*, which were from one to two, or three inches above ground, and very near the margin of the pot. On the 21st, the second larva was again visible on a little shoot close to the earth, and two more larvæ, less advanced, on other small shoots, were seen on April 14th.

Here it may be proper to state the fact, that after hibernation, neither of the larvæ fed at all on any of the mature sprays of the plant, which seemed apparently healthy and vigorous, but pertinaciously sought the young tender shoots, eating a portion from under a leaf, then a little from another leaf, or moved away entirely, creeping over the ground and through all impeding growths, until, with unerring instinct, another shoot, sooner or later, was reached; thus I was continually losing sight of one or more of the larvæ often for days together, but only to find them again by the aid of new blotches appearing to betray them.

Towards the end of April they ravaged so recklessly the small stock of their food remaining in the pot, never staying to clear the whole underside of a leaf, but changing their quarters so often that I began to fear they would desert the pot and escape altogether. At that time I was unable to obtain a fresh supply of their food, and to make sure of completing my observations of the larva when full grown, I confined the two largest individuals in a bottle, and supplied them with cut portions of their food, on which they thrrove, and therein attained their full growth of barely half an inch; and on the 15th of May one fixed itself for pupation by a cincture across the back of the fourth seg-

ment, on a bit of linen, the second followed in the same way on the 16th, and on the 21st and 24th they changed to pupæ. The two remaining larvæ soon after fixed themselves, but died unchanged, probably the effect of insufficient food.

The newly-hatched larva is very minute, with a glistening blackish head, stoutish body, of a light drab-green colour, velvety and hairy ; its size is doubled in eight days, and when a month old it is of the usual *Lycaena*-shape, one line in length, thick in proportion, with small retractile head, the body of a dull pinkish-brown colour, with darker dorsal stripe, and rather hairy.

On waking up in spring it is of a dingy slaty-green colour, and early in March it moults, when the old skin is left attached to the plant like an empty shell, not in the least shrivelled, but split open laterally along the ridge above the legs. The larva now becomes quite pale green on the back, broadly pinkish along the lateral ridge, and still hairy. Early in April it is nearly an eighth of an inch long, of greenish flesh colour, palest on the second segment and dorsal eminences, pinkish in the dorsal hollow, and also beneath the spiracular region, the long whitish hairs closely resembling those of the food-plant.

The last moult occurs about the 21st of April, when it is three-sixteenths of an inch long, and attains its full growth of barely half an inch early in May ; during this interval of course the larva shows all its characteristic details, which are just like those of the local Northern variety (*Artaxerxes*) (as described 'Entom. Monthly Mag.', vol. v, p. 176), and all I can say of the type form is that the green colour is more lively and full, and the pink along the lateral region is darker, inclining to purplish.

It only remains for me to state that my experiments have proved to me the truth of what Zeller long ago suspected, and since then Newman and others have believed that *Artaxerxes*, *Salmacis*, and *Agestis* (*Medon*)

are but one species.\* (W. B., 4, 2, 79; E.M.M. XV, 241.)

POLYOMMATUS (LYCÆNA) AGESTIS (*MEDON*), VAR.  
ARTAXERXES.

Plate XVI, fig. 1 (1 b, 1 c, 1 d, 1 e, 1 g).

On the 8th May, 1868, Mr. Doubleday kindly presented me with the larvæ of *Artaxerxes*, about half grown, which had been sent to him by Mr. Wilson, of Edinburgh, who found them on *Helianthemum vulgare*.

They fed well on this plant, and were always on the undersides of the leaves, to which they assimilated so well as to be difficult of detection.

The larva is of the usual *Lycæna* shape, somewhat onisciform, short and thick, being arched on the back, sloping on the sides, the spiracular region swollen and projecting laterally much beyond the ventral prolegs. The segments appear deeply divided, especially on the back, down which are two rows of rather peaked cone-like eminences, with a dorsal hollow between them; the second segment simply rounded above, and rather longer than the others, and tapering a little near the head, which is very small and retractile; the anal segment tapers very little, is rounded behind and hollowed above on the sides; the twelfth segment has a small but prominent wart on each side.

The half-grown larva is from three to four lines in length, pale green in colour, and clothed with very fine and short whitish bristles. The dorsal line beginning on the fourth and ending on the twelfth segment is of a faint brown, though wider and more strongly marked just at the beginning of each segment, and widest at its termination on the penultimate.

\* [The elaborate notice of the two reputed species by the late George Wailes, in his "Catalogue of the Lepidoptera of Northumberland and Durham," published in the 'Transactions of the Tyneside Naturalists' Field Club for 1858,' vol. ii, part 4, p. 189, should here be noted.—H.T.S.]

On the sides of the fifth to the tenth segments are double oblique lines slanting backwards and downwards, of paler green in front and darker green behind than that of the ground colour. At this stage of growth the lateral projecting ridge of swellings broadly pink, with scarcely an indication of a central paler stripe; the belly and ventral prolegs pale yellowish-green; the anterior legs flesh colour. The head black, the base of the papillæ flesh colour, and a streak of the same above the mouth.

On approaching full growth its length is about half an inch; the oblique stripes gradually disappear, and its green colour becomes rather darker; a pinkish-white stripe runs along the lateral prominences, broadly bordered above by a stripe of rose-pink, and beneath by a broader stripe of still darker pink. The spiracles are flesh colour, situated in the upper pink stripe, very minute and inconspicuous. The ventral prolegs green, the anterior legs pinkish, spotted with brown.

Two changed to the pupa state on May 21st, and a third a week later, all in nearly perpendicular positions, amongst, and slightly attached to, the stems of the *Helianthemum* by a few silk threads near the ground.

The pupa is about four lines in length, smooth, and without polish, rather thick in proportion, the head rounded and prominent, the thorax rounded above, the abdomen plump and curved a little backwards, its extremity being hidden in the shrivelled larva-skin which adheres to it. The colour of the head, thorax, and wing-cases blue-green, a black curved streak obliquely placed on each side of the head; the abdomen yellowish-flesh colour, a deep pink stripe at the sides enclosing a central white one, which can also be seen showing through part of the wing-covers.

Two of the butterflies appeared on June 13th and 14th. (W. B. ; E.M.M. V, 176.)

## THYMELE ALVEOLUS.

## Plate XVI, fig. 2.

At the end of May and beginning of June, 1874, I captured a score or more of these butterflies and shut them up in a glass cylinder with bramble sprays; they would not, however, spare me more than seven or eight eggs, which were laid on June 2nd or 3rd. The larvæ began to hatch on June 12th, and by the 18th four had come out; the rest died in the egg, having begun, but not being able to complete their liberation. Three also of the four larvæ, that had been safely hatched, soon died; but the survivor thrrove and grew, by July 9th it was one-sixth of an inch long, by the 17th nearly half an inch long. About the 1st of August it moulted for the last time, and soon attained its full length of about five-eighths of an inch, afterwards increasing only in stoutness. After the end of August it remained apparently dormant for days together, eating only at intervals; and about September 20th it became a pupa.

Meanwhile, on July 29th, I had found another larva in the locality where I took the imago, which very nearly corresponded in growth with my bred example, but it unfortunately died without changing.

Throughout, observation of their appearance was very difficult, owing to their habit of living in concealment, and in fact, I believe the mortality which prevailed among my small stock was owing to disturbance caused by attempts at peeping, measuring, &c.

Probably, in freedom, the perfect insect has some constant method of depositing her eggs; but the few I had, having been laid in confinement, seemed to be placed indifferently on the upper or under sides of leaves, or on stems; however, I think the newly hatched larva chooses the upper surface of a small leaf for its habitat (unless, perhaps, as I have lately thought on reflection, it may prefer the blossom), and

settling itself along the midrib, at once spins several silken threads overhead for a covering, under which it feeds by eating away the upper cuticle; and when it has made a blotch of some little extent, it moves away and repeats the process on another leaf; as it grows bigger, still choosing the upper surface of a leaf for its standpoint, it forms its covering by drawing down another leaf over it, fastening the edges here and there with stout threads, and feeds away in the cave thus formed; when, however, it has attained some size I think it must come out of its cave and eat the neighbouring leaves in the usual way, but I only once or twice saw either of my larvæ thus exposed of its own choice; the habit throughout the larval state is to be very sluggish, and a great part of the time must be passed by the larva in resting with its head curled round sideways towards its tail.

In the very limited time I could devote to searching for larvæ, I found numbers of deserted caves, but only one tenanted, and this seemed to prove that my examples in confinement acted pretty much as they would have had they been at large. As mentioned above, I gave the butterflies bramble sprays to lay on, and I searched brambles for the larvæ, and came to the conclusion that stunted bushes with small leaves had the preference, the large juicy leaves of strong bushes apparently offering no temptation.

I did not omit to look for the other plants on which the larva has been said to feed; in the same locality were some half dozen plants of mallow (*Malva moschata*), but I am positive they bore no traces of larvæ, and there was not one plant of teasel. The wild strawberry (*Fragaria vesca*) has been suggested also as a likely plant, and I think it would probably occur wherever the butterfly is seen; but, as far as I feel justified in giving an opinion, I do not think there is any need to look for anything more than the bramble (*Rubus fruticosus*).\*

\* I fear I was too positive here as to bramble being the usual food

The egg is globular, with base rather flattened ; the shell ribbed rather irregularly with about eighteen ribs, and transversely reticulated with very even fine lines, which do not stop at the ribs, but cross them, giving their edges a rough appearance which is not real, but only caused by the ribs, otherwise translucent, becoming opaque where the lines cross ; as usual a small space on the top of the egg is covered only with very fine concentric reticulation ; the colour is very pale green all over.

The young larva makes its escape by cutting a large round hole through the top of the egg ; in colour it is very pale green, with head and collar shining black ; every tubercular dot bears a pale bristle, longish and straight on the head and thirteenth segment, but on the other segments bifid, with the tips curved on either side like an unbarbed double fish-hook. When about a sixth of an inch long the colour is pale purplish-pink, the head still black ; when nearly half an inch long it is pale green again, the whole skin now thickly set with short straight hairs ; the bifid bristles have been parted with, I imagine, at the first moult.

When full-grown, the length is rather over five eighths of an inch, the figure very stout, the head horny, globular, and stuck like a knob on the second segment, which, however, is not so strikingly narrow as in *Thanaos Tages* ; the skin granulated in appearance ; the head and whole body covered thickly with short fine pale hairs ; the general colour a pale ochreous-green, the second segment pinkish, and a faint reddish tinge over the back of the other front segments ; a thin dorsal, and somewhat broader subdorsal line, not easy to be seen, of the ground colour, and a faint spiracular line ; the spiracles not much darker than the ground colour ringed with the same tint as the lines ; the belly freckly ; the head

of the larva ; Mr. W. H. Harwood has discovered that it feeds more commonly on *Potentilla fragariastrum* (the barren wild strawberry or strawberry-leaved cinquefoil).—J. H.

and collar very dark purplish-brown, the upper lip paler.

The pupa is enclosed in a cave between two or three leaves, similar to that in which the larva lives, but fastened with stouter silk, and the openings protected by a loose pale yellow webbing. Its length is not quite half an inch, the figure thick and stumpy; the eyes prominent, the wing-cases well developed; the whole skin rather rough; the middle of the head, the eyes, and the back set with short stiff hairs, the ground-colour reddish-grey, the wing-cases pinkish-grey; the abdomen tinged with brownish-red along the back; on the centre of the head, on the eyes, and on either side of the thorax above the wing-cases, are some blackish-brown marks; there are smaller marks in pairs down the middle of the thorax, and there are transverse rows of spots on the segments of the abdomen, the largest and darkest being next the wing-cases; the hairs are light brownish-red; the anterior spiracle is black, the others of the grey ground-colour, ringed with black, and placed within the largest dark blotches. (J. H., 11, 2, 75; E.M.M. XI, 236.)

I hardly know if it is worth recording that a larva, reared from an egg deposited by a butterfly of the type form, has resulted in an imago of the variety *lavateræ*, Haw. (J. H., 17, 11, 75; E.M.M. XII, 232.)

#### THANAOS TAGES.

##### Plate XVI, fig. 3.

On the 28th of May, 1868, I happened to meet with this species on the wing in a thicket and brought home with me three specimens alive; and luckily having a plant of *Lotus corniculatus* potted, I covered it with a glass cylinder and placed them therein.

After a few days I saw that two of the butterflies were dead, whilst the third still looked lively, and fortunately proving to be an impregnated female, she

deposited on the leaflets of the plant a few pale greenish pellucid eggs, of a somewhat elliptical figure standing on end.

About the middle of June I noticed the egg-shells were empty, but I could not see the young larvæ either then, or for some time subsequently, until June 28th, when at last I detected them, three in number, they had been all the while feeding in little caves, formed by drawing together three leaflets with silken threads, and it was the glistening of these threads in the sun that first caught my eye. Each cave was formed by the two outer leaflets being drawn almost close together (leaving space enough for the ejection of "frass"), and the middle one being bent over them like a curved roof; all this was managed quite naturally, so that the cave passed easily for a leaf not quite expanded.

Some of these caves had already served their turn and been abandoned for newer ones, and it appeared that the larvæ had been feeding on the inner surface of the leaflets; in the others I was able by the help of a lens to detect through the interstices somewhat of the fat form of their tenants.

On the 30th of June I turned one out for figuring; it was then nearly three-eighths of an inch long, with a prominent dark purplish-brown head, covered with minute pale greenish points; the body rounded above, a little flattened underneath, plump, and tapering a little at each end; the second segment much smaller than the third, especially in the part just behind the head; the colour of the body a pale rather bluish-green, somewhat paler still on the sides and belly, a distinct dorsal line of darker green, a subdorsal line faintly paler than the ground colour; the whole surface of the back and sides irrorated or shagreened with exceedingly minute greenish-white points.

These most interesting little fellows continued to feed and grow, and as they began now to eat away the whole thickness of the leaflets forming their caves, their ravages exposed their bodies to light, and as soon

as this happened they moved off to new habitations ; this change of residence always took place at night, though from the slow and deliberate pace at which they moved, it could hardly be called a "flitting."

Throughout July these larvæ consumed a great quantity of food, so that I had frequently to renew my plant of *Lotus*, but still they hid themselves, and kept quiet so persistently, that I no longer wondered how it was that no one had ever found this common species for me, even though its food-plant was known.

After various moultings I secured three more figures of them at intervals, and by July 31st they had attained their full growth. At this time the larvæ is nearly three-quarters of an inch in length, with the back a little arched and the belly rather flattened, being just of the same form as when younger ; the body is very plump, and thickest in the middle segments, the segmental folds distinct, each segment also subdivided into five portions, the broadest one in front ; the head is somewhat heart-shaped and flattened on the face ; the colour of the body is rather more of a yellowish-green than before, the minute raised points blackish, the dorsal line a darker green, and the subdorsal paler stripe delicately edged above and below with a fine faintly darker line ; the anterior pair of tubercular dots just perceptible on each segment, but only with a strong lens ; the spiracular region forming a slight ridge of paler whitish-green, the spiracles very small and red in colour ; the head is purplish-brown as before, but with the addition of an ochreous streak from the crown down the front of each lobe, united below by another broad transverse streak at some distance above the mouth, and also of a spot of the same colour on each cheek.

Having sent one to Mr. Hellins, I found my two remaining larvæ had, early in August, fairly left their hiding places, and were ascending the sides of the cylinder, first one and afterwards the other ; presently having gained a footing on the green leno cover at the

top, they began to spin threads of silk and to pucker up the leno into a fusiform shape ; the foundation threads were very strong and thick, spun parallel to each other, in a little transverse series at each end of the retreat. The larva that was first on the leno contrived to complete its hybernaculum ; but the other, after spinning the two bundles of parallel threads to form the two ends of its intended winter quarters, was unable to find the leno slack enough for puckering into the required shape, and began again the next day at another part, but was again defeated, and finally relinquished its attempt on the leno, and went below among the plants. Some weeks afterwards I found it on the earth killed by mildew. The same fate befel the one which I had sent to Mr. Hellins.

The other slumbered safely through the winter, until early in April, 1869 a ray of sunshine reached it, and I saw the larva coming out as though in distress to escape either the warmth or the strong light ; whereupon I shifted the glass to a pot containing a violet plant, and the larva crawled down the sides till it found the violet leaves, and then selecting two near the bottom in a shady position, in an hour it had spun a retreat between them as they lay horizontally one below the other. But I suppose this operation exhausted its strength, for when, after waiting in vain for the butterfly to appear at the proper time, I pulled the leaves asunder, I found it had died without having become a pupa. (W. B., 1, 70; E.M.M. VI, 233.)

#### STEROPES PANISCUS.

##### Plate XVII, fig. 1.

On the 7th of June, 1883, I received from Herr Heinrich Disqué, of Speyer, a batch of eggs laid by a female butterfly of this species on *Glechoma hederacea*. Why he had given her this plant on which to lay, I cannot say. The shape of the head is hemispherical,

with flat base, its colour white and shining, like porcelain. On the 11th of June some few showed a dark spot at or near the top, and on the 12th this had spread to a large, dingy-greyish blotch, and sullied the entire surface as the shells became more transparent. On the 13th this dark central blotch seemed to change to a blackish round spot, and on the 14th was perfectly black and shining, when it soon became evident it was the naked head of the larva eating its way through the shell; and in the course of another hour or two the larva crept out of this hole in the top of the shell, on which it made its breakfast, eating away the sides of it until but very little remained.

The newly-hatched larva has a largish head and uniformly cylindrical body, which is velvety white; the head is black and shining, and there is a shining black linear plate on the second segment.

Various plants were put with the three larvæ first hatched besides grasses, and in the evening I had the satisfaction of seeing a small notch was eaten quite through the edge of a leaf of *Brachypodium sylvaticum*, and a larva lying along the leaf close by.

After feeding a couple of days the colour of the body changes from white to a very faint tint of bluish-green; the larva crawls very slowly and keeps near to that part of the leaf it has attacked, showing no disposition to wander away.

The hatching continued, but in a desultory way, being evidently delayed by the cold north winds at this time. On the 19th three or four seemed to have made their arrangements for moulting, by drawing the tips of the leaves together, so as to form little cylindrical retreats; these were securely fastened by spinnings of silk. In two instances these retreats were made near the middle of the leaf with a portion curled round and fastened, this process being made practicable by the larva having previously eaten out a notch from the edge both above and below the part that was curled round.

By the 22nd they had doubled their length, but

some accidental deaths having occurred, I put out the remaining six or seven on a growing tuft of the grass, and presently watched one creep up to near the top of a leaf and make cross ties of silk, which drew that part of the leaf together in a somewhat tubular form, an occupation which lasted four hours, before the little creature retired within to rest from its labour. The next morning I could see where it had eaten a piece out from the edge of the leaf half an inch below its residence, and could then detect the similar abodes of five others. By the next evening the tip of the leaf had become very much more attenuated, and formed quite a cylindrical long point as far down as the notch at the edge.

By the 30th of June this individual had become whitish-green on the body, with a decided bluish-green soft dorsal line, faintly bordered with a paler whitish stripe ; a whitish subdorsal line was also just visible ; the head brilliantly black and shining, and also the linear plate on the second segment. This segment seemed not to have grown, and now appeared short.

After some time their tubular residences became more conspicuous, and the leaves on the top of which they were formed became more ravaged below them, and by the 20th of July most of them were bitten through at the midrib and had fallen away empty, and larger tubes were made on fresh leaves. On opening one of these on the 3rd of August I found the larva waiting to moult ; it was exactly 6 lines long, of a delicate light, rather bluish, green, with a dorsal line of slightly darker green, edged with a fine soft whitish line ; a broad very pale bluish-green stripe of the back follows, then a line of darker green like the dorsal line, followed by a stoutish line of whitish ; the head black and rough ; the linear transverse plate on the second segment is interrupted on either side by the green ground separating a small part of the black ; an unbroken black rough plate is on the anal segment.

On the 6th of August I took a larva from its tube,

or rather, I should say, that in attempting to tear away a small strip from the tube the larva took fright and leaped nimbly out of it, then remaining, without a movement, perfectly still for nearly two hours. It was of a green colour, very soft and velvety-looking, the lines on the body as above described; the head dark green, marked with black on each lobe and between them on the crown, a black spot on each side of the face, ocelli black; on the very short second segment is a black transverse mark in the middle and a black spot close outside the subdorsal line, and another smaller lower down; these are the development of the former linear plate; the anal segment is very pale green, with a dorsal mark of black on the flap. The subdorsal line is the palest and is well relieved above and below by the darkish full green, which it runs through; beneath this are two extremely faint fine paler lines, only just perceptible. The length at this time was  $6\frac{1}{2}$  lines. The general green colour is a trifle deeper than that of *Pamphila linea*.

On the 18th of August I saw a larva two-thirds of an inch long and very slender, commencing to make a new tube for itself. On the 24th I saw a larva in the act of leaving its case, after all the leaf at either end had been eaten away to the midrib, by which alone it was supported. I cut it off and then figured it with the larva upon it, deliberately advancing towards the stalk to find another leaf to construct a fresh dwelling. This larva measured exactly 9 lines long and was in all details as above described, except that the remains of the black linear plate on the second segment were now only a dorsal spot and a fine dot well below the subdorsal region. The anal flap was a trifle concave on its surface, tapering to a rounded-off point beyond the anal prolegs; it bore a broadish black dorsal rough stripe. The segments behind the thoracic were all subdivided by transverse wrinkles into five rings, of which the first ring was the widest, the second nearly as wide, and the other three very much narrower.

On the same day whilst putting this larva back on the grass I saw another of exactly the same dimensions, but it looked paler and as though it had quite recently moulted ; it was gliding at an almost imperceptible pace in quest of a fresh leaf, which it soon found, and in the course of an hour or two it was domiciled, as was also the larva I had laid upon a leaf after figuring it.

On the 29th of August I saw one larva 9 lines long laid up waiting for a moult, partly on the edge and partly on the underside of a leaf, with the head downwards ; in this condition the second segment was longer and larger than the third. About this time several larvæ showed themselves as they quickly devoured their cases, first eating the lower part of the leaf below their tube all but the midrib, then devouring the top of the leaf above the tubular part, and lastly the tube itself, until by degrees it became too short to shelter them, when they deserted it and cut through the midrib, which caused the tubular remains to fall away, after which they glided off to select a fresh leaf for the construction of another tubular abode.

On the 1st of September the larva that had laid up since the 29th of August moulted during the night, and had made itself a tube.

On the 4th of September I picked up two larvæ deserting the grass ; I then cut off all the remaining tubes and found that I had seven or eight larvæ ; two only had black markings as in my earlier figure, the others had moulted them away ; that which I had figured on the 24th of August had moulted since the 1st of September, and was now 10 lines long and with a plain paler green head, and hinder plate of the same colour as the belly, the ocelli black, and the finest possible line of black at the junction of the lobes on the crown.

On the 23rd of September I observed one on the stick used to prop up the grass, it was lying along the stick at full length, which gave me a good opportunity

for measuring it, when I found it to be exactly one inch.

It is a very timid larva, as, when at all disturbed, it coils itself up in a moment, and so remains for an hour or more.

On the 27th of September I observed another just an inch long. It had the upper lip yellowish, the mouth blackish, the ocelli black; the primrose-yellow subdorsal line was relieved, both above and below, by a line of deeper green than the ground colour, followed beneath by a soft paler line; lower, again, the trachea showed through the skin as a faintly paler fine line, on which were the reddish spiracles; all the rest as before mentioned.

By the 6th of October all had attained the length of one inch and were of a very pale yellow-greenish tint, with all the details of the lines as before, only fainter; the next day I found one  $1\frac{3}{4}$  lines in length. Most of them now made very imperfect tubes and seemed content to lie along the underside of a leaf, the top of which they soon devoured.

On the 10th of October one had spun itself up by drawing a leaf round itself as it lay on the underside. The leaf not being broad enough, the two edges did not quite meet and the interstice had been well covered with whitish silk, forming a complete cylindrical silk-lined hybernaculum; other larvæ seemed ready to follow this example.

On the 18th of October I noticed one larva lying under a leaf which it had caused to hang down by its having eaten out a portion from one side of the leaf close to the midrib about an inch from the stem, and a smaller wedge-shaped portion from the other side of the leaf. The weight of the larva made it hang down gently at an angle, and as the larva was thus lying with its head downwards towards the tip of the leaf, when hungry it advanced to the tip and ate it away, and, having satisfied its hunger, moved backwards towards the bend of the leaf. (W. B., Note Book IV, 196.)

## PAMPHILA ACTÆON.

## Plate XVII, fig. 2.

On the 11th of June 1873, Mr. Thomas Parmiter, of Kimmeridge, Dorset, very kindly sent me four larvæ of this species found by him on *Brachypodium sylvaticum*, a grass growing abundantly along the downs facing the sea, where the subsoil is of chalk or limestone, from Swanage to Weymouth. Along this region the detached haunts of *Actæon* are scattered, each locality being within one or two hundred yards or so of the shore, having a southern aspect, and well sheltered from the north by a hill. In these favoured spots *Actæon* is plentiful.

I found these larvæ take readily to *Triticum repens*, which was potted for them, and their habit of feeding was as follows: ascending high up the blades of the grass they began eating out a wedge-shaped portion from the side which cut off the pointed top, leaving an oblique edge above, and either fed there on the upper edge for a little, or proceeded to eat away large wedge-shaped pieces from the side of the blade; when tired of feeding, they removed lower down to the middle of the blade, and there spun a coating of white silk from one side to the other, causing the two edges of the blade to draw together a little, and then in the silk-lined hollow they would rest for awhile, coming out again to feed. For a time, I placed one of the larvæ on *Triticum pungens*,\* a stouter and tougher grass, with which it seemed perfectly contented, and behaved in all respects as it had before on *T. repens*.

These larvæ had attained their full length by the time they reached me, but continued to increase somewhat in bulk till June 20th, and by the 23rd they had ceased to feed, and were beginning to fasten

\* *Triticum pungens* is not British; probably *T. junceum*, which grows on sandy coasts, is here meant.—H. T. S.

themselves within more closely constructed retreats, formed where two blades of the grass obliquely crossed each other ; however, a few days later, probably from the grass not being quite free from mould, two of them abandoned their places, and found others suitable to themselves, where they pupated in horizontal positions under a projecting ledge that supported the glass superstructure of the cage. One of the individuals that remained spun up on the grass and pupated there, with its head uppermost in nearly a perpendicular position.

The butterflies appeared on July 14th, 17th, and 18th, viz. two females and a male ; in each case the imago came forth at night, the insect being ready for flight in the morning.

The full-grown larvæ were from six-eighths to seven-eighths of an inch in length, and in figure (leaving out the head) tapered a little to each end, the second segment being the smallest and very short. The head swells out again beyond the size of the second segment, but not to such an extent as in some others of the genus.

But, in justice to Professor Zeller, I will here quote from his admirable observations and account of this larva from the egg to full growth, which were published in 1862 in ‘The Weekly Entomologist,’ vol. I, pp. 10—12.

“ \* \* \* \* When full grown they seek for a retired shelter, which they find in a corner between some leaves, of which they form a spacious habitation by spinning in the open parts a thin wall of whitish silk web, with large and very irregular meshes ; the resting place being thickly covered with whitish silk, but most thickly where the tail of the larva is to rest. In four or five days it changes into the pupa.

“ This larva is of the general form of *Pamphila*, i.e. cylindrical, tapering towards the tail and head, the latter being large and, as it were, separated from the trunk by a string. It is of a pale greyish-green, with the dorsal vessel darker, and edged with a slender pale

yellow line on either side, and enclosing a pale longitudinal line along its middle. A narrow yellowish line runs above on the side and a broader one below. The two dorsal lines are prolonged as far as the middle of the head, and run to the end of the flat anal shield, which is narrowly edged with pale yellow. The transverse folds of the skin are yellowish. The head is rounded, with inflated cheeks, the brownish mouth sunk deep between them. The colour of the head is brown in the young larva, paler in the older ones, with the two yellowish lines very distinct and exteriorly edged with brown,—greenish in the oldest ones, with lines stouter and paler, without darker edges. The legs are very short and greenish, the ventral ones having usually a longitudinal yellowish stripe. The two snow-white patches on the underside of the tenth and eleventh segments are conspicuous as in *P. lineola*, *sylvanus*, and *comma*, and appear to be a peculiarity of the whole genus. This white substance is spread out at the tail end of the larva of *P. Actæon*, when it has formed its chrysalis case."

As regards my four larvæ, but little can be added to the foregoing,—merely that the spiracles were pale flesh-colour, situated on a fine and faint pale line, which touched them in front and vanished behind each spiracle; that the lower pale stripe was inflated, and rather overlapped the ventral prolegs; that the surface of the head and the body was slightly roughened with minute granulations, especially on the thoracic and three last segments, which bore a number of minute black points, that the rest of the upper surface was faintly freckled with rather darker green than the pale ground; that the ocelli were black, and the anal shield fringed with a few fine hairs; and that as they matured their glaucous tint gave way to a paler and more yellowish-green.

The slender pupa is three-quarters of an inch in length, two lines across the arched thorax, where it is widest, though the head, with its large prominent eyes,

is almost as wide; the top of the head is a trifle flattened, and has a beak-like process projecting forwards of a flattened triangular shape, its base lying across the head between the eyes; the abdomen tapers very gradually towards the anal portion, which ends in a prolonged and blunt flattened tip, furnished with a circlet of exceedingly minute recurved hooks. The wings, antennæ, and legs are plainly developed, and the proboscis is extended at full length down the abdomen, from which it lies wholly free towards its extremity.

Its colouring at first, and up to within four days of the advent of the imago, closely resembles that of the last larval period, viz. a very pale and delicate yellowish-green, on which all the lines of the larva, though faint, are distinctly to be seen. The first indication of its approaching change is a gradual suffusion of pink over the thorax, which, with the wing covers, in twenty-four hours becomes of a dingy greyish-purple hue, the back of the abdomen a light brownish-olive tint, the divisions appearing as paler rings, the beak and tail purplish-grey. In this advanced stage the change of colour is considerable even in an hour or two; it grows by degrees deeper olive on the back of the abdomen with a dingy purple dorsal stripe; as the body and thorax darken to purplish-black, so in proportion do the frontal and caudal projections fade away to a greyish ashy paleness, and become semi-transparent, as though empty; finally, the surface becomes as though covered generally with a misty reddish-grey bloom. It is in the purple-blackish stage of colour that the fine cincture, drawn tight round the front of the thorax, and secured a little behind to each side of its abode by a thickening of the silk, is most plainly seen by its whiteness; the few stout threads that cross over the pupa at each end, more or less obliquely, do not touch it at all, but serve as security for its habitation, and possibly as protective outworks while it lies fastened on its silken carpet. (W. B., 22, 7, 73; E.M.M. X, 86.)

## PAMPHILA LINEA.

## Plate XVII, fig. 3.

Of this long wished for larva I had the great pleasure to receive six fine examples on the 11th June, 1882, from Mr. W. H. B. Fletcher, who, most kindly mindful of my desiderata, when finding himself at their locality in the eastern division of Sussex, on the evening of the 9th, succeeded in sweeping them from *Holcus lanatus*, a very soft pubescent grass, with which they assimilated both in colour and texture most remarkably well.

They had evidently done moulting, and continued feeding well on the above-mentioned grass from seven to fourteen days, and seemed rather to prefer it to *Brachypodium sylvaticum*, another soft-haired grass, which they also ate freely enough for a time; the experiments of trying them with this latter grass suggested itself to me from the circumstance of my having, a few years ago, gathered some of it, quite by chance, which contained a spun-up pupa, that shortly afterwards produced this butterfly.

Their movements were very sluggish, and after eating a considerable quantity of food, they very slowly began one after another to enclose themselves within two, or sometimes three leaves of the grass, joined together longitudinally by lacing or spinning, with white silk, the edges more or less close to each other, and became completely hidden; the earliest spun itself up on the 18th of the month, another on the 20th, and the others during the next three days.

The perfect insects, full-sized specimens, were bred on the 15th and 16th of July following.

The full-grown larva is 10 lines in length, its general figure of moderate substance, stoutest in the middle of the body, tapering a little from the thoracic segments towards the head, which is globular and projecting, larger than the second segment, which is

remarkably small and short ; it tapers also gradually on the last four or five segments when seen from above, and when viewed sideways the back then appears slightly arched and sloping gradually to the anal flap, and this is a trifle flattened and rounded off behind ; the belly is flat and the legs are all well beneath it and rather short ; the segmental divisions are very delicately defined, also most particularly the subdividing transverse wrinkles, which by no means arrest attention, but have to be diligently sought for.

In colour the head is of rather a deeper green than the body, and rough with minute points, the upper lip of a pinkish hue, is smoother and deeply channelled, the ocelli black ; the body above is of a tender and delicate light green ground-colour, without any gloss, and on the thoracic segments the skin is besprinkled with black points of extreme fineness, so that they do not affect the delicate colouring of the green ground ; the dorsal stripe is the darkest marking of green and is very narrow on the second segment, and thence uniformly wider until near the end, where it becomes very gradually attenuated on the anal flap. This dorsal stripe is of a darker, rather bluish-green, having a stoutish line of paler green running through the middle, and bordered outside in stronger contrast by a stout line of green still paler than the ground ; the subdorsal line is of the same pale green, but thinner ; below, at a little distance, the trachea shows partly through the skin and on it can be discerned the rather prominent reddish flesh-coloured spiracles, below these again, at a little distance, follows an inflated paler stripe of almost creamy-whitish, extending round the anal flap, which often hides the belly and legs from view when the larva is in repose, but at other times, when examined beneath, these are seen to be wholly green excepting a transverse patch of white on the front of the ventral surface of the eleventh and twelfth segments.

On tearing open the coarse reticulation of white silk

which held the leaves together, and formed a lining to the oblong puparium an inch and a quarter long, I found the pupa itself to be of the length of  $8\frac{1}{2}$  lines and very similar in form to that of its congener *Actæon*, having the end of the trunk lying free from the abdomen, held in position, head upward, by an oblique cincture behind the thorax, and the anal tip secured by a fan-like spread of fine hooks at the extremity fixed in the silk lining, but the head had the frontal tapering beak shorter and more bluntly pointed. The colour then was the same light green as that of the larva, of which the paler lines could still be faintly traced. (W. B., 10, 3, 83; E.M.M. XIX, 244.)

## PAMPHILA SYLVANUS.

## Plate XVII, fig. 4.

I have reared this insect from a larva found feeding on *Luzula pilosa*, nearly full grown, on May 1st, 1862. It continued to feed for four or five days and then spun a silken lining in a cylinder previously formed by uniting the edges of a leaf of *Luzula*, in which it changed to a pupa—the perfect insect appearing on the 8th of June.

The larva was very slow in progression ; cylindrical above, flattish beneath ; the body pale bluish-green, an indistinct dorsal line of darker green, and a paler line above the feet, which are small. The head large and singularly prominent—of a crimson-brown colour. The thoracic segments taper towards the head, giving it a strangulated appearance. (W. B., 9, 9, 62; 'Weekly Entomologist' I, 45.)

## PAMPHILA COMMA.

(One of the few larvæ of which there is no figure in this volume.)

On the 6th of September, 1880, I received five eggs of this species laid in a chip-box and adhering to the lid, side, and bottom. These were laid by the female butterfly at Geneva, about the 1st of September (the butterfly had been captured on the 28th of August by the Rev. John Hellins by the Mer de Glace, near Chamounix, in Switzerland.)

The egg is dome-shaped, with a small circular depression on the summit, the surface apparently smooth, colour creamy white, though in three instances appearing more or less speckled from some dark scales from the parent adhering to them. On the 10th of September, without growing darker, their colour became of the faintest possible tinge of bluish-green.

On the 18th of December I sent one egg to Mr. Hellins to examine with his microscope, and he reported that the dark spot in the central depression at the top of the egg (which was then visible in all the eggs, though not when I first had them) to be composed of minute black scratches or irregular lines.

The shell is of the shape of a button or drop, broadest at the base, where it is about  $\frac{1}{28}$  of an inch wide, top rather flattened, about  $\frac{1}{60}$  of an inch across; the height is about  $\frac{1}{33}$  of an inch; the shell slightly roughened all over, very much like the shell of a hen's egg; colour dead white, with a slight blue tinge.

Unfortunately none of these eggs hatched, though I kept them for more than a year. (W. B., Note-book, IV, 46.)

## **APPENDIX.**

[THE following pages contain notes and descriptions of larvæ prepared this year (1885), by the Rev. John Hellins, with the view of supplying some of the gaps which occur amongst the descriptions left by the late Mr. William Buckler.—H. T. S.]

These notes consist partly of extracts taken from my diaries, partly of descriptions made purposely this summer. I am painfully aware how much they fall short of the excellence of my late friend's work, and only offer them as stop-gaps.—J. H.

## GONEPTERYX RHAMNI.

## Plate I, fig. 2.

My notes on this species are as follows:—In 1871, July 3rd, I found several larvæ feeding on *Rhamnus frangula*; on July 13th, three of these had become pupæ, whilst some remained quite small. In 1874, I bred the imago on July 11th.

This year (1885) I have had larvæ sent to me by Mr. W. R. Jeffrey, June 16th; by Mr. Holland, of Reading, June 26th; by Mr. Bignell, July 2nd; and by Mr. Harwood, July 15th. On June 17th, I searched some bushes of buckthorn near Exeter, and on one stunted bush, growing in a sheltered nook on the side of a hill, I found five eggs and four larvæ; and on the same bush I continued to find eggs and larvæ till the end of the month, my last find being dated June 30th.

How long the egg state lasts I cannot say, not many days I imagine; I had some larvæ hatch on June 19th, which moulted June 28th, July 4th, and July 6th; were full fed July 13th to 15th; became pupæ July 16th to 17th; and the butterflies appeared July 29th to 30th. I fancied there was a moult on June 23rd, but on testing this point with another larva hatched June 28th, I found it did not moult till July 6th, so I conclude the larva moults but three times; the skin seemed in almost all cases to be eaten. Several of the larvæ which I found, or received from friends, had been stung; of the survivors the first became an imago July 26th, the last on August 3rd.

The duration of the three stages of egg, larva, and pupa, must be limited to something less than two months; the remainder of the year is passed in the perfect state.

The egg is laid singly, generally on a rib of the under side of a leaf of *Rhamnus frangula* ;\* but one

\* I have met with the larva on *Rhamnus catharticus*.—H. T. S.

leaf, which I picked, had two eggs on the under side and one on the upper; the shape of the egg is flask-like, cylindrical, set on end, about 1·3 mm. high, ·4 mm. in diameter at the base, ·5 mm. at the widest, narrowing to ·15 mm. at the top; the shell is very delicate and glistening, with twelve longitudinal ribs or flutings, and fine intermediate parallel lines; colour silvery green at first, turning at last to yellow. The larva makes its escape from the egg by a large irregular hole in its side, leaving the neck and top perfect, and does not eat the empty shell.

The newly-hatched larva is nearly 2 mm. long, the head being the widest segment, and the body tapering backwards to the tail; the skin shining, in colour dull yellowish, sparsely sprinkled with tiny black dots, but there is a dorsal line of the ground colour left clear of these dots; the usual trapezoidal and lateral warts are blackish dots, but distinguishable by having a clear space round each; and each bears a short pellucid knobbed bristle. In five days' time the larva is  $4\frac{1}{2}$  mm. long, the body has become green, but the head has a yellowish-brown tinge, the whole surface of the back set with tiny black dots; but the trapezoidal and lateral warts are larger black dots surrounded by clear spaces. After the moult on the eighth or ninth day the length is 8 mm., the head is green set with black dots, the rest of the description much as before. After the next moult the length is 15 or 16 mm., the colour becomes a fuller green, the white spiracular line appears, the trapezoidals still have clear surrounding spaces, there are more black dots, and some more bristles. The length just after the last moult is 20 mm.; the full-grown larva is 34 mm. long, in shape having the back rounded but the ventral surface more flattened, the body stoutest from the third to sixth segments, the second tapering rapidly to the head, which is rounded, the hinder segments taper gradually, the thirteenth rapidly, the anal flap ends squarely; the six subdividing rings of each segment well defined, the subspiracular

lateral ridge rather sharply edged; the second and third pairs of true legs are set upon stout bases, the ventral prolegs also powerful; the colour of the back is a uniform dull glaucous green, melting at the spiracles into a greyish-white broad stripe, which reaches to the subspiracular ridge and is there pure white, except on segments 2 to 4 where it has a yellow tinge; the spiracles inconspicuous, being yellowish-white; the belly of a more tender green than the back, but becoming glaucous down the middle; the head and all the back finely set with tiny black dots of uniform size, each emitting a short pale bristle; on the pale stripe the dots are whitish, below this the dots are dark, but not so black or so numerous as on the back. As the larva matures the trapezoidal s become indistinguishable, and the pulsating dorsal vessel becomes visible as a faintly darker line.

For pupation the larva fixes itself head upwards, with a belt of silk round the body, and then bends the body in a curve outwards; but I never saw the actual change.

The pupa, the difficulties of whose description Albin got over by calling it "odd-shaped," is about 25 mm. in extreme length, and 9 mm. in width across the wing-cases; the general outline is pointed at either end, the back of the thorax humped in a short curve, the abdomen rising again a little from the waist, and continuing nearly straight to its tip, with a very slight keel along the centre; the shoulders angulated, a lateral ridge thence to the anal tip; the wing-cases are produced in front to a narrow edge until quite half their depth projects beyond the line of the belly, from this projection the abdomen curves gently to its tip, which is a bluntly-triangular spike, flattened, the ventral side covered with curved spines (none on the back); the tongue-case forms the edge of the projecting wing-cases, but stops some little distance before reaching the abdomen. The colour of the pupa generally is a bluish-green, the wing-cases more grass-green, the

sharp point at the head yellow, tipped with purplish-brown; a purplish-brown spot on the shoulder; a faintly deeper green line down the back; a subdorsal row of faint dusky spots; the lateral ridge yellowish, edged above with deeper green; the wing-cases and their nervures softly marked with freckles; a purplish line down the belly. As the imago matures the antenna-cases show red, and the wings and body become yellowish. (J. H., 19, 9, 85.)

#### PIERIS BRASSICÆ.

#### Plate II, fig. 2.

The sight of the caterpillars of this species feeding on cabbages, and their unpleasant odour when plucked off and crushed under foot, are among my very earliest recollections; and I suppose the disgust which they inspired has ever since kept me from caring to know much about them. And so, with the solitary exception of a memorandum about a variety of the pupa, I have no notes of an earlier date than the past summer (1885), when I did what I could to atone for past neglect, and braved the unpleasant smell of cabbages for weeks continuously. I could get no butterflies of the first flight, nor eggs from them; but Mr. Bignell, at Plymouth, kindly hunted for larvæ, and sent me two batches of youngsters, on July 8th and 14th; most of these were already stung, and I got from them only two pupæ, luckily varieties, and I bred the butterflies on August 13th and 16th, being of course examples of the second flight. Females of this second flight were captured by Mr. Jeffrey and myself, and laid eggs on August 12th and 16th; the larvæ hatched August 18th and 22nd, were full fed about September 10th, and the last had become a pupa by September 15th. Meanwhile Mr. Bignell found eggs and sent them to me on September 1st, and again on September 29th,

and I found eggs in my garden on September 15th; these later dates might seem to indicate a third flight of butterflies, and a third laying; however, I have not bred a single imago in confinement from the pupæ of the second brood, so I must attribute the late oviposition to butterflies which had by some means been delayed in their development. The eggs of September 1st produced the larvæ next day, and these had turned to pupæ by October 10th; the eggs found by me on September 15th produced larvæ September 25th and 26th, many of these were killed by frost and rain, and the survivors are now, November 3rd, feeding out-of-doors on *Tropæolum majus*, but are not more than 12 mm. long, so their chance of becoming pupæ seems small; the larvæ from the eggs of September 29th were hatched on October 10th, but I did not keep them. One brood, that sent me by Mr. Jeffrey, I watched carefully, and noted the date of each change; eggs laid August 12th, larvæ hatched August 18th; first moult, larvæ 4 mm. long, August 22nd; second moult, larvæ 8 mm., August 26th; third moult, larvæ 12 mm., August 31st; fourth moult, larvæ 20 mm., September 3rd; all had become pupæ by September 12th, thus completing this portion of their changes during the warmer weather, in the space of a month: the cast skins were never eaten. I fed my larvæ on cabbage and horse-radish leaves, and noticed that they certainly preferred the former. I found the eggs laid on *Tropæolum majus*, and have seen the larvæ on that plant frequently, but in their cage they would not eat its leaves if they could get cabbage. Mr. W. H. B. Fletcher tells me he has seen larvæ on turnip leaves, and Mr. W. H. Harwood mentions in addition charlock and mignonette. Though of course feeding and living openly, the larvæ do a good deal of spinning for their foothold; they are quite social in their habits, and feed in company, and rest in rows side by side most fraternally.

To speak first of the egg laying, the eggs are laid

on end in batches, but without linear arrangement, on either surface of the leaf; the females in confinement deposited little groups of six, or eight, or a dozen; but those we found at large were in much larger companies. I found two batches of fifty or sixty each, and Mr. Bignell sent me at one time sixty-five, and at another time more than one hundred all grouped together; the egg is flask-shaped or skittle-shaped, standing on end, rather more than 1 mm. in height, and more than  $\frac{1}{2}$  mm. in diameter below, and about  $\frac{1}{3}$  mm. across the top, with from 15 to 17 longitudinal ribs, and delicate even transverse reticulation; in colour dull yellow. Shortly before the larva is hatched the egg shows three coloured, the narrow neck and top being white and empty, then just at the shoulder a black spot, being the head of the larva, and all below yellow, the colour of the body of the larva. The young larva eats the empty eggshell; it is over 2 mm. in length, with large black head, the body pale greenish-drab, the usual warts large and black, the front pair of trapezoidal being largest, each carrying a long hair; on the second segment a pair of large black square spots separated by a pale line, the back for the width of the space between the front trapezoidal pale with a dusky thread through the middle, a large black plate on thirteenth segment. As the larva grows, before the first moult, some tiny black specks begin to show; when through the first moult, the length being 4 mm., the body is yellowish-green, the dorsal line distinctly yellower, the warts grown larger and blacker than before, the hairs still long and stiff; when through the second moult, 8 mm. long, the colour yellow with a green tinge on the front segments, black head and warts as before; after the third moult, 12 mm. long, the middle of the back and lower part of the sides more yellow, the subdorsal region greyish-green, head and spots black; after the fourth moult, 20 mm. long, the head becomes pale, and this seems the great distinction of the final skin. The full grown larva is about 42 mm. in length, rather slender, cylindrical, tapering

slightly from about the middle towards the head and tail, the head rounded, narrower than the second segment, the skin at last shining, the usual warts sharply prominent, the whole body sparsely set with short hairs; the colour of the back is a light greyish or bluish green (the blue tint predominating in some examples and the yellow in others), the dorsal line deep rich yellow, the spiracular region paler and duller yellow, the belly more greenish; the lobes of the head bluish-grey, finely powdered with small black dots bearing short light hairs, and broadly margined all along their front edges with black; the space between these black borders pale yellow, the upper lip blue-grey, the mouth black; the usual warts black and shining, surrounded by large dull black spots, the largest of which is that which surrounds the lateral wart, the rest of the back is set with black spots of two or three magnitudes, arranged on the subdivisions of the segments. All the legs yellowish with black marks; the black shining plate on the second segment divided by the dorsal line, which also enters the black plate on the thirteenth segment for half its length; below the spiracles only small and pale black spots occur; the spiracles indistinct, pale with black rings.

The larva for pupation fixes itself head upwards or horizontally on a flooring of silk, with a belt round the middle, and a holdfast for the anal legs. The pupa is 26 mm. long, well proportioned and stout, somewhat angulated, the head with central spike or horn, the back keeled throughout, the keel rising very high on the thorax in two steps to a bluntish point, and then falling in the same way to the waist; the abdomen not so prominently keeled, at the end the keel bifurcates forming the two sides of the spike; the shoulders angulated, from these a subdorsal ridge angulated along the wing-cases with two prominences, the second being the higher. There is a variety in which this second prominence becomes quite a spike. (Dr. Jordan sent me a specimen in 1874, and the two

pupæ I obtained this summer from Plymouth had this spike.) The outline of the belly a gentle curve from the head to the end of the wing-cases, where the tongue-case projects free for 1 mm. (but not so prominently as in the engraving, Plate II, fig. 2a; Mr. Buckler seems to have been the first to notice this projection, no previously published figure shows it); thence the abdomen goes in a second and gentler curve to the tail; the anal spike flat, almost square, being made up of the two outside ridges with a triangular piece between, and set on the ventral surface with many short spines curved at the tip and then spreading into broad edged hooks. There are two or three varieties of colour, the most common is very pale greenish-white; the head spike blue at the base and yellow at the tip; dorsal keel, shoulders, and spiracles yellow; the whole skin sparingly freckled with tiny black dots; the dorsal and subdorsal ridges marked with larger black spots, and several of intermediate size set in patterns on the sides; the tip of proboscis blackish. Another variety is bluish-green all over, with yellow ridges and spiracles, with the black spots much smaller and fewer in number. Another variety is mottled with the green and white tints. These varieties were developed side by side in the same cage. (J. H., 3, 11, 85.)

## PIERIS RAPÆ.

## Plate II, fig. 3.

(See Mr. Buckler's brief notice at p. 19.)

This was the first species I looked out for this year, in order to obtain eggs, but the early flight was so scanty in its numbers that I failed to catch an egg-laying female; however, one must have visited my garden, for after a good deal of searching I found five larvæ (and no more) during the first week in July;

these became pupæ between July 15th and 23rd, and the butterflies were bred between the 21st and 27th ; at this last date there came plenty of females of the second flight, and I found eggs from time to time up to September 8th ; and from the earliest of these eggs, found at the end of July, I reared the larvæ and bred several butterflies at the end of September and through October, thus obtaining a partial third flight ; the greater part of my pupæ, however, remain over for next spring. During the warm weather the larva seems to be hatched about six days after the egg is laid ; the moults are not easy to detect because the change of colour is slight and the larva eats the cast skin, but I believe there are four moults at intervals of about four or five days each, and the pupa is developed in five or six days' time from the fourth moult. I have found the eggs on *Tropaeolum majus* and *canariense*, cabbage, charlock, mignonette, and horse-radish ; to these plants Mr. Harwood adds hedge mustard (*Sisymbrium officinale*) and watercress.

The egg is laid singly (sometimes a leaf in a favourite corner will get three or four eggs left on it, but each deposited separately), standing on end, and is flask-shaped or skittle-shaped, being just 1 mm. in height, rather more than  $\frac{1}{3}$  mm. wide and about  $\frac{1}{6}$  mm. across the top ; with eleven, twelve, or thirteen longitudinal ribs, coming up evenly and neatly to the apex (one of the distinctions between this species and *napi*), with delicate even transverse reticulation. The colour at first is very pale greenish-yellow, afterwards becoming more yellow, some even orange-yellow. The young larva eats the empty shell, and in several cases I found larvæ, which had hatched in my pill boxes, after eating their own eggshells attacking and devouring their neighbours who were yet unhatched ; of course this was done in the absence of proper food, and would hardly occur in nature, but I do not remember to have seen such a thing among all the hundreds of other species I have reared from the egg. I have seen

other young larvæ eat one another, but not attack their brothers yet in the egg ; however, after proper food had been supplied I noticed no more cannibalism with *rapæ*. The newly hatched larva is not quite 2 mm. in length, slender, in colour yellow all over, head and all, the usual dots looking like small raised warts and each bearing a longish pale bristle ; as it feeds it becomes greenish and tiny black specks begin to show. When the larva is 4 mm. long the head is brownish, the body shining green, the usual warts are prominent and white, but the bristles are black and look knobbed ; when the length of 7 mm. has been attained the whole larva is green, the warts as before white, each set with a stiff black bristle, the back powdered with black dots of two sizes, and with fine downy pale hairs, the dorsal line is distinct by being free from dots, but there is no difference of colour, and as yet there is no spiracular line ; when the larva is 11 mm. long, after I believe the third moult, the yellow dorsal line is distinct, but there is no yellow yet in the spiracular line, the warts and dots as before ; when the larva is through the next (and last) moult and is 15 mm. long, the yellow spots appear in the spiracular line, and the black dots multiply. The full grown larva is 28 or 29 mm. long, cylindrical, tapering slightly from the middle towards either end, the general colour a dull green, a thin yellow dorsal line, a faint yellow spiracular line, which carries a row of yellow spots, namely, one apiece on segments 3 and 4 ; from 5 to 12 there are two spots on each segment, namely, one immediately in front of the spiracle and touching it and the other some little distance behind ; the spiracles are pale in black rings ; there is no yellow spot on segment 13. The trapezoidal and lateral warts are small but somewhat prominent, and are white in colour but with dark bristles ; the whole skin set with small black dots down to the legs, more thickly on the back, and these dots emit fine hairs ; the legs are whitish-green ; the belly glistening whitish-green. As the larva matures there becomes

apparent on the back of the ninth segment a pale square spot, apparently caused by an internal organ showing through, but the dorsal line is not interrupted by it.

The larva fixes itself head upwards, or horizontally, by the anal legs, and a belt round the body, for pupation. The pupa is about 20 mm. long, angulated, the head with a sharpish central horn, the back keeled to the tail, the keel rising up quickly on the thorax to a blunt point, then falling to the level of the abdomen, which goes off in a long curve to the tail; the shoulders slightly angulated; a subdorsal ridge begins with two points (the second being highest), below the waist, and continues in a slight curve to the tail; the belly nearly straight; the anal spike short, flattened, almost square, the ventral side of the tip set with curled spines. The colour seems very varied, but as all the varieties occurred side by side on the cover of the tin box in which my larvæ were reared, I could not account for their difference; the commonest variety I have is dusky drab, finely powdered over the back with black, the dorsal and subdorsal ridges inclining to yellowish, and dotted with black, the horn on the head lined with black; the wing nervures drab, with blackish spaces between; the tongue-case (the tip of which projects free for a short distance) and antennacases blackish; a few are darker than this, looking quite smoky, and the pale lines not so clear; on the other hand, some are much lighter, of a pale drab, scarcely with the faintest freckling of black, and a few black spots along the ridges; and some again having either a rosy pink, or else a dull green tinge suffused all over them. (J. H., 5, 11, 85.)

## PIERIS NAPI.

## Plate II, fig. 4.

(See Mr. Buckler's brief notice at p. 20.)

I saw a few butterflies on the wing in May and June of this year, but could not capture a female; in the beginning of August I was in a locality where the second flight was out in numbers, and on the 10th I captured two females, which on the 12th began to lay, and in a short time deposited a large number of eggs. The larvæ were hatched in six days' time, on the 18th; in four days passed their first moult, August 22nd; four days afterwards came the second moult, August 26th; and in three days more the third moult, August 29th; and in four days more the last moult, September 2nd. The first pupa was developed September 8th, and the last September 14th; none of them have so far disclosed the imago, and no doubt are lying over for the first flight in next year. Mr. C. G. Barrett kindly sent me some eggs from Belfast August 25th, and the larvæ appeared next day. I saw the butterfly on the wing up to September 9th.

I have never seen the larva at large, but I fed those I have reared this season on horse-radish, which they seemed to like very well, eating the leaves and the stout leafstalks voraciously. Mr. W. H. B. Fletcher tells me he has found it on *Nasturtium officinale*, and abundantly on a small cress growing in ditches in the New Forest, which he took to be *Barbarea vulgaris*; Mr. W. H. Harwood believes he has found it on *Cakile maritima*.

The egg is laid singly, on end, and is flask-shaped, being  $1\frac{1}{4}$  mm. in height, nearly  $\frac{1}{4}$  mm. wide, and about  $\frac{1}{8}$  mm. across the top, with (generally) fourteen longitudinal ribs not meeting very neatly, and with regular delicate transverse reticulation; colour at first pale green, afterwards becoming more pale and silvery; thus, although much like the egg of *rapæ*, it is longer,

not so neat at the apex, and always greener in colour. The young larvae eat their empty eggshells, but I saw no attempt to eat other eggs. The newly-hatched larva is all but 2 mm. long, with the head large, and the body stoutest in front, the skin shining, the colour (paler than in *rapæ*) being pale yellowish-white, head and all, the internal vessels showing through of a darker yellowish-drab tint; all the warts prominent, though not so distinct as in *rapæ*, each with a long very pale hair; after the larva begins to feed the colour soon becomes a full green. After the first moult, when the larva is  $3\frac{1}{2}$  mm. long, the colour is pale yellowish-green, with the front part of the body much deeper in tint, the warts whitish, the hairs from them darker than before, and the small dark dots with short hairs appear. The cast skin is eaten. After the second moult the length is 6 mm., the head shining, clear yellowish-green, the body glaucous green, especially in front; the warts white, a few of the small dots black. After the third moult the length is 10 mm., the colours as before, but many more small black dots have come; there is a dorsal line formed simply by the absence of these black dots; there is a dusky green spiracular line, on the lower edge of which is now a row of round yellow spots, each enclosing the black spiracle. After the fourth moult the length is 16 mm., and the last skin appears; the full-grown larva is about 26 mm. in length, cylindrical, the head rounded, narrower than segment 2, the body stoutest at segment 7, tapering thence slightly forwards, and more rapidly towards the tail; the usual warts sharply prominent, and the whole skin including the head set with sharp points, all furnished with short hairs; the colour a full green, head rather paler, the dorsal line shows rather deeper green, the dorsal and ventral colours are sharply separated by the yellowish green indistinct spiracular line, on which come the black spiracles, each in a round yellow spot; the belly is of a paler greyer green, all the legs are green; on the

back of the ninth segment is a pale square spot, caused by an internal organ showing through; the trapezoidal and lateral warts are whitish, but all the other points and dots are black of three or four sizes, arranged on the subdivisions of the segments; but there are *no black spots below* the spiracular line; all the little raised points below that are white.

This larva is much like that of *rapæ*, but can be known from it by its lighter green, by the absence of a yellow dorsal line, by the single yellow spot in each segment *enclosing* the spiracle, and by the absence of black dots below the spiracular line.

The pupa is fastened by the anal hooks, and a belt of silk round the body; it is about 20 mm. in length, angulated, the head with a single horn, the back keeled throughout, the keel rising quickly to a blunt point on the thorax, then falling to the level of the abdomen and continued but not prominently to the anal spike, where it bifurcates to form its sides; the wing-cases a little angulated, from below the waist a subdorsal ridge, which begins with two raised points, and goes on to the tail; the outline of the belly much straighter, the tip of the tongue-case just standing free, the eyes somewhat prominent; anal spike flat, nearly square, the under side of the tip set with curved and clubbed spines. In colour there are two chief varieties, the one of a light tender green, the other of a very pale pink buff; some of the green ones are almost without markings, except that the prominent parts—the horn, dorsal and subdorsal ridges—are dull yellow, and the wing-cases tinted with yellowish; but the greater proportion of the green ones have the prominent parts dull yellow, and a number of spots purple brown varying in depth of tint; these are placed on the sides of the horn, on the thoracic eminence, three or four large ones on the upper edge of the wing-cases, and a row of small ones at the segmental divisions on the dorsal and subdorsal ridges of the abdomen. There is nearly the same difference between lightly and darkly-spotted

examples of the buff variety, but this variety has the largest and darkest development of these purple-brown spots, and has the wing nervures marked out also. (J. H., 6, 11, 85.)

#### ANTHOCHARIS CARDAMINES.

##### Plate III, fig. 2.

In 1864, July 5th, I had a larva sent to me on *Hesperis matronalis*, the imago from which appeared 8th May, 1865. On 15th July, 1885, Mr. W. H. Harwood kindly sent me two larvæ just come to full growth, and gave me the information that he is accustomed to find the larva principally on *Sinapis arvensis*, which he considers its chief food, also on *Cardamine pratensis*, *Sisymbrium officinale*, *Alliaria officinalis*, and seeds of garden rocket.\* My two larvæ became pupæ on July 18th and 19th, and I had the pleasure of seeing the change in each case; the time from the opening of the slit in the back of the larva skin to the clearance of the anal tip was about seven minutes.

The full-grown larva is about 27 mm. in length, rather slight in figure, nearly cylindrical but with a subspiracular ridge, stoutest at the sixth segment, thence tapering each way, the head rounded, about as wide as the second segment, which is narrower than the third, anal flap ending bluntly; the larva looks wrinkled, each segment having six subdividing rings, with apparently some complication at the folds; the skin is thickly set with fine raised dots of two sizes, bearing fine pubescence; the colour is a uniform dull glaucous green on the back, passing through grey green into the pure white spiracular stripe; the belly is of a more tender green than the back; the dots on the back are black placed on greyish little warts; on the

\* I have found the larva on *Turritis glabra* and on the flower-stems of horse-radish.—H. T. S.

belly they are not so numerous; the spiracles are inconspicuous being whitish, but not so white as the stripe on which they are placed.

The larva fastens itself for pupation by the anal legs, and with a belt of silk, and soon assumes an arched posture, and becomes a pupa in less than two days; the beaked head-piece when first disclosed hangs down limp, like the tassel of a man's old fashioned night-cap, and the wing-cases project at first but little; in a short time, however, the form fully develops, and the pupa skin hardens. The pupa is 20 mm. long, very slender, and very attenuated at either end; the general outline of the back from end to end is concavely arched, and it is much flattened, though the thorax swells out just a little; the head ends in a long beak or horn; the tail has no spike, but the tip is set with rounded knobs and small bristles (under the microscope reminding one of the appearance of a raspberry); on the ventral side the wing-cases swell out to a somewhat acute point just at the middle of the body; along the spiracular region is a ridge dividing the dorsal and ventral surfaces; the colour at first is a dull deep green. One of my pupæ in about ten days became pale grey tinged with pink, darker on the back with a pale dove-grey middle line and a broad stripe of dove-grey on each side, the edge of the lateral ridge pinkish-white, the nervures of the wings paler than the ground; the other pupa has retained its green colour to the date of my present writing, and has the anal tip pink. (J. H., 22, 9, 85.)

#### ARGE GALATHEA.

#### Plate III, fig. 4.

In 1861 I received eggs of this species from Dr. Knaggs, July 27th, and the larvæ were hatched August 18th, but I have no further notes of their progress. In 1863 I again had eggs, and on March 31st, 1864,

I noted that I had a larva 6 mm. long, and feeding after hibernation; by May 14th this larva was more than 12 mm. in length; it was full fed before the middle of June, and the imago was bred July 22nd. In the month of May, 1866, I had a quantity of various larvæ sent to me from Torquay for naming, and among them I found several of this species. During July, 1876, I captured some of the butterflies, and obtained eggs; and the larvæ were hatched on July 31st.

On June 20th, 1885, Mr. G. C. Bignell kindly sent me two larvæ, which had been lately taken in the New Forest; they became full fed in two or three days, and hid themselves in moss for pupation on June 25th and 27th. On July 24th I bred one imago; the other died in the pupa, probably having been injured by me when examining it for description. On August 13th Mr. W. R. Jeffrey sent me some eggs, and the larvæ were hatched on August 29th, and are now apparently growing very slowly. From my own observation, and the information given me by my friends, I conclude that the parent butterfly simply drops her eggs in rough grassy spots, without attaching them to any object; the young larva eats up its eggshell almost entirely, and thenceforward feeds on grasses; it seems sluggish in its movements. I do not know on what kinds of grass it has been taken, but I find it will eat any of the common grasses from my garden; and I have noted *Dactylis glomerata* in particular. It hibernates when very small, becomes full fed in June, and changes to a pupa without suspending itself in any way, or making a cocoon; I think it would hide itself, as my examples did; I found they had got among the thick moss, with which I had furnished the bottom of their cage, and apparently made little hollows for themselves by turning round. Mr. Buckler's figure (Plate III, fig. 4 d) shows the cast larva skin at the tail of the pupa, but its attitude must not be taken as indicating suspension.

The egg is large and plump, stumpy ovate in outline,

VOL. I.

being 1 mm. in height, and nearly 1 mm. in its widest diameter, but about  $\frac{2}{3}$  mm. across the top, and the same at the base which is cupped. The shell looks like dull bone-white china, and is covered all over with very shallow rhomboidal network, with very tiny knobs at the knots, and with a central patch of finer meshes on the top. The young larva is about  $2\frac{1}{2}$  mm. long, squat looking, with large head, and body tapering thence to tail; the skin not shining, the usual warts round and prominent, each bearing a longish stiff curved bristle; the head granulated and set with some hairs rising from round warts; colour a whitish buff, with yellowish-brown dorsal, and rather broader subdorsal, lines; the warts whitish, the head brownish with whitish warts. At the length of 6 mm. the larva has not changed its appearance much. The full-grown larva is about 30 mm. in length, stout in figure, cylindrical, tapering from the fifth segment both to the head and to the tail; the head is proportionally small, almost globular; the anal flap ending bluntly, and furnished with two short spines pointing backwards; the skin dull, finely set all over (head included) with short hairs; all the legs are small and short, and are placed well together. In colour this species is variable, the variety of which I have seen most examples has the ground colour buff, and the lines more or less brown; but I can now describe in full only the variety I have seen this summer, with the ground colour of very pale yellowish-green, the dorsal line very dark green but beginning paler on segments 2 to 4; in the subdorsal region comes a stripe of paler yellower tint than the ground, edged with darker green, faintly above, but more strongly below, these edgings most distinct about the middle of the body; the spiracles small, round, black; there is a subspiracular line paler than the ground but not distinct; the head pale pinkish-brown, anal spikes pink; belly much the same colour as the back; the true legs faintly brownish, the ventral prolegs green; the pubescence pale.

The pupa is very stout and plump, 15 mm. long and 7 mm. at the widest, just where the wing-cases end; the head-piece slopes from the shoulders but ends squarely, the back of the thorax swells up roundly, falling in a little at the waist, whence the abdomen swells out again in a round curve to the tail, the segments being very slightly marked; the ventral outline is gently curved; the wing-cases rounded; the abdomen ends in a square piece, on which is placed a short blunt spike set at the end with two little groups of short *straight* spines. The general colour is pale putty-white; the wing-cases and antenna-cases freckled with pale brown, the abdomen with a more yellowish tinge, the segmental rings marked with deeper yellow, and there is a broadish yellow stripe down the middle; the spiracles in one specimen were large, and ringed with brown; the pair of spiracles at the shoulders large and dark brown in colour, thus being conspicuous on the pale ground; the anal spike chestnut-brown. (J. H., 25, 9, 85.)

#### LASIOMMATA ÆGERIA.

Plate IV, fig. 1 (see *ante*, p. 27).

Mr. Buckler having spoken of the larva after hibernation, I may give dates for the summer brood: June 26th, 1885, I captured a female, which laid a good many eggs the same day; the larvæ were hatched July 5th, full fed about July 27th, and had all become pupæ by August 2nd, and the butterflies were bred between August 11th and 17th. I saw examples of this second flight at large up to September 24th.

The egg is laid on its end upon a blade of grass, in form it is dumpy, not globular, but with upright sides and round top, just 1 mm. high, and slightly less than 1 mm. wide; it has no ribs, the shell is very glossy, covered all over with fine irregular raised network,

stoutest on the top ; the colour at first pale whitish-green, in about a week a dingy cloudiness comes in the colour, and just at last at the top of the egg the black head of the larva shows through. The young larva eats up its empty eggshell, and is just 2 mm. long, with large, brilliant, jet black head, the body all over very pale greenish-white, the usual dots darker and shining, with pale long curved hairs ; some black bristles on the head. The first moult came in five days, when the larva was 5 mm. long and the head became green, the general colour pale green, a deeper green dorsal and a whitish subdorsal line appeared, and the bristles increased in number, and the pink anal points were developed. The second moult came in five days from the first, when the larva was 7 or 8 mm. long ; the green colouring became more vivid, and the hairs more numerous. The third moult came in another five days time, when the larva was 13 mm. long, and this was apparently the last ; the full fed larva was 23 mm. long.

The pupa was formed about six days after the last moult ; the pupa is about 12 mm. long, stout and squat in figure, the head notched at an obtuse angle, the back of the thorax swelling up in a steep curve, and falling in gradually at the waist, the abdomen swelling in a bold curve to the tail ; the under side of the thorax nearly straight, the abdomen curved ; the anal spike short and stout, though somewhat flattened, the ventral side of the tip crowded with curved spines, which hold most tenaciously to the silken pad spun by the larva. The colour varies, some being pale green tinged with whitish yellow, the wings outlined in brown ; on the abdomen a short subdorsal row of three small whitish-yellow spots ; others had the ground colour green, but covered all over with very fine smoky freckles. (J. H., 9, 11, 85.)

## LASIOMMATA MEGÆRA.

## Plate IV, fig. 2.

On July 9th, 1864, I received a larva from Mr. Buckler, who must have been at that time rearing the species; the imago emerged July 23rd. In May, 1874, I obtained ova, and took a description on the 25th; the larvæ began to hatch on June 3rd and moulted for the first time on June 10th, by June 24th they were about 8 mm. long, and I bred the butterflies July 20th, and following days; these had gone through all their stages in about two months. About the end of March, 1881, I captured two larvæ on grass; about the middle of April these became pupæ, and the butterflies appeared May 13th and 21st; these had come from eggs laid in the previous July or August, and had hibernated as larvæ. The dates given above mark the times of the two broods.

The egg is deposited singly on grass blades; in shape it is dumpy conical, somewhat truncated, with the top rather rounded; the shell is glistening, covered with rows of shallow reticulation on the sides and all over the top, with a central spot of very small reticulation; colour at first pale green, then whitish, at last dull greenish-white, with some dark purplish spots on the top.

The newly hatched larva has the head globular and large, half as wide again as the second segment, with the body tapering from it; all the usual dots prominent, and each carrying a long curved bristle; colour greyish, with a brownish dorsal line which widens in the middle of each segment, and contracts at the folds, two finer lateral lines; the head shining pale olive with little black warts carrying black bristles, the dots on the back ringed with brownish. At the first moult the colour is changed; it becomes dull green all over, the head bright green, the dorsal line of a green rather deeper than the ground, but edged with paler lines;

in the subdorsal region comes a darker thread, followed below—first by a paler line, then a dark one again, and then another pale one; the spiracular line is more yellowish-green. The full-grown larva is green, with darker dorsal line, and paler subdorsal and spiracular lines.

The pupa is suspended by the tail, and has two varieties of coloration, green and a very dark brown. It has a short, stout, flattened anal spike, the tip of which is thickly set with pale, curled spines; leading up to it on the ventral side is a sort of scutcheon, but not prominent, bearing on its higher edge two tiny knobs; the tip of the proboscis, though lying close to the abdomen, is really free from it for about the length of  $1\frac{1}{2}$  mm. (J. H., 12, 10, 85.)

#### HIPPARCHIA JANIRA.

##### Plate V, fig. 1.

I have bred this species, but have nothing that I can say for certain about it, except that it hibernates in the larval stage; I have several times taken the larvæ feeding upon grasses in the spring. The full-grown larva is full green, with darker dorsal line, and the two anal points pink.

For pupation the larva suspends itself by the tail; at the change the shrivelled skin remains enveloping the tail of the pupa, and supporting it. The pupa is stout, the head with two little horns; the tail ends in a short, stout curved spike, on the tip of which are a few straight feeble bristles, quite unfit for suspending it; on the ventral surface close to this spike is a scutcheon of a somewhat rounded form, with a central cicatrice, and on the front edge two little projecting knobs, which with the spike no doubt keep a hold on the cast larva skin. The colour is green, with some brown spots and lines. Boisduval has figured the

pupa suspended by the naked anal spike, but I do not think this can be correct.

Mr. G. F. Mathew informs me that he has watched the female of this species dropping her eggs at random, as she fluttered above some coarse grass. (J. H., 7, 11, 85.)

### HIPPARCHIA TITHONUS.

#### Plate V, fig. 2.

On 21st August, 1873, I captured some butterflies, which at once laid eggs; the larvæ hatched September 15th; they moulted about the middle of October. On January 21st, 1874, they were about  $3\frac{1}{2}$  mm. in length, on March 16th about 6 mm.; by April 25th they had grown to 12 mm.; June 4th, some measured 19 mm., and were full grown; the first imago was bred August 18th. In 1885, June 20th, Mr. Bignell sent me a larva taken with some *Galathea* larvæ in the New Forest; it was then 18 mm. in length, and in a day or two became 19 mm.; on July 1st it suspended itself by the tail for pupation, became a pupa on July 5th, and the imago appeared July 26th. I fed the larvæ on *Poa annua*, *Dactylis glomerata*, and other common grasses.

The egg is cylindrical, standing on end, the top flat, but rising in two shallow steps, the sides with sixteen ribs separated by wide grooves, the ribs continued over the top to an irregularly-shaped central spot filled with reticulation, the transverse lines shallow but regular, the shell glistening, at first all over very pale yellow, becoming in four or five days whitish with light chestnut brown blotches; of these there is a large central one on the top, and a strong band of them round the egg near the top; the rest are scattered. Just before the larva is hatched the egg becomes pale purplish, on which the markings are darker but not plain.

The young larva eats the empty eggshell ; it has the head large and globular, the usual dots large, each with a stiff hair ; the ground colour is whitish-grey, with rusty yellow dorsal and subdorsal lines ; along the spiracles are two fine lines connected on each segment, and so looking like a row of squarish patterns, the head yellowish, the dots brown, the hairs whitish ; the front segments show the internal vessels. In October, after the first moult the larva becomes green, with brownish head ; in January it is noted as being of a vivid full green, with a few blackish hairs, the head pale greenish ; in March it is 6 mm. long, in colour full green, with dark green dorsal line, yellowish-green subdorsal line, and whitish-green spiracular line ; head pale green, tinged with brownish, the skin with a few blackish hairs. In April it is about 12 mm. long, in colour greenish-grey, with dark dorsal, indistinct greenish-white subdorsal, and whitish spiracular line, head pale greenish-brown. At the end of April it moults for the last time, in June it becomes full fed. The full-grown larva is about 19 mm. long, stoutest at about the seventh segment, thence tapering to either end, the back rounded, and the slope towards either end falls in a curve ; the belly is flatter, the head wider than the second segment, and flattened in front, the face being rather wider below than above ; the subdividing rings give a wrinkled look to the skin ; the whole body, head included, is closely set with fine short pale bristles ; the anal flap with two short spines pointing backwards. The colouring varies a little, generally the ground is pale ochreous freckled closely on the back with reddish-brown ; the head freckled rather darker than the body, and the lobes outlined with a dark line ; the dorsal line dusky, widening on the middle segments ; the subdorsal line a little paler than the ground, edged especially above with some dark freckles ; the subspiracular stripe pinkish-white edged above with brown freckles, and followed below by a yellow tinted stripe, belly like the back ; the spiracles

very small, black; the anal spikes pale drab. Some examples are rather darker than this, and some paler with a greenish-grey tinge.

The larva suspends itself by the tail for pupation. The example I had this summer did not get rid of the cast larva skin, but the pupa hung with its tail still enveloped. The pupa is about 10 mm. long, and 4½ mm. across the wing-cases, stumpy in figure; the head ends squarely whether looked at sideways or from above; viewed from below the corners are angulated almost like little horns; the shoulders of the wing-cases are also sharply angulated; the back of the thorax rises in a short curve, and drops in at the waist, the abdomen swells out in a longer curve, the segmental divisions marked by projecting edges; the wing-cases bluntly rounded off below, the ventral outline slightly curved; the anal tip is furnished with two extremely short points, one can scarcely call them spikes, which seem to have no hooks, and on the ventral surface there is a sort of scutcheon, on the anterior edge of which are set two knobs, each with a little curved spine pointing backwards, and the use of this arrangement seems to be for retaining hold on the cast shrivelled larva skin, and so suspending the pupa safely, a task for which the little anal blunt spikes are wholly unfitted. The general colour of the pupa I had this summer was pale drab, the antenna-cases tipped with brown, the wings outlined a little with brown, the abdomen had a more ochreous tint, and its rings on the upper side were edged whitish, and with brown streaks interrupted by a middle pale stripe, spiracles brown. The general effect rendered this pupa an inconspicuous object.

I have, however, an example or two of my 1874 pupæ, which are marked with much more contrasting tints; the head and wing-cases are ochreous, marked and lined with dark brown, and the back has a middle stripe of drab with a broad dark brown stripe on either side of it, and then a subdorsal drab stripe bordered

again with dark brown ; and there seems to be a good deal of variation in the distribution of the dark markings. (J. H., 26, 9, 85.)

### HIPPARCHIA HYPERANTHUS.

#### Plate V, fig. 3.

In 1861, July 27th, I received eggs from Dr. Knaggs, the larvæ from which hatched August 18th, and I must have carried them through the winter, and sent some to Mr. Buckler in the spring of 1862, but I made no further notes. On July 28th, 1885, I captured a butterfly, and confined her with plenty of growing grass, *Dactylis glomerata*, *Poa annua* and others ; next day, July 29th, she laid a great many eggs, but without attaching them to anything ; they were simply dropped and I found them on the bottom of the cage. The larvæ hatched August 19th, and moulted about the end of September ; they are now about  $5\frac{1}{2}$  mm. long, sluggish, but feeding a little on *Triticum repens*. This species hibernates in the larva stage, and feeds up in May.

The egg is dumpy, conical in shape, with rounded top, about .7 mm. high, more than .8 mm. at its widest, and about .6 mm. over the top ; the shell shining, faintly reticulated (or pitted) in rows ; this ornamentation is so slight that it cannot be compared to ribs. The colour at first yellowish-white ; this soon turns to pale brownish, but the shell remains clear and shining, and in about three weeks time the head of the larva shows brown with two small black dots of eyes. The young larva has a large head, and a stumpy body tapering to the tail, about 1.7 mm. long, the usual dots large, and each bearing a stiff, curved, ragged bristle ; there are no anal points till after a moult ; colour pale drab, the head horny, warm brownish, the dorsal and subdorsal lines yellowish-brown, the dots slightly darker than the ground. When between 5 and 6 mm.

long, the larva is greenish-grey, the head pale brown, the strong dorsal line dark, the subdorsal line paler than the ground but edged with darker, the spiracular line whitish with dark edges, the space between the subdorsal and spiracular lines is slightly darker than the back; the two anal points short but distinctly formed. Of the full-grown larva after hibernation I have no notes, nor of the pupa, except that it is very dumpy in figure. (J. H., 12, 10, 85.)

#### EEBIA CASSIOPE (*EPIPHRON*).

Plate VI, fig. 2 (see *ante*, p. 33).

For three years following, 1874-75-76, I obtained eggs through the kindness of Mr. W. H. Harwood; these eggs came to me in the first or second week of July, the larvæ hatched between July 15th and 20th. I got them to feed on *Aira præcox* and *A. cæspitosa*, they seemed to thrive through the autumn, and by the beginning of October they attained the length of 10 to 12 mm.; then they would hibernate till towards the end of next February, when they began to move again, but after that every year they died off, so that I never brought one to full growth.

The egg is laid singly, standing on end, upon grass blades, and is in shape cylindrical, twice as long as wide, its top diminishing in two steps, its centre plain, the sides with eighteen broad shallow flutings, neither clearly defined nor quite straight, with delicate and regular transverse reticulation, the shell slightly glossy; the colour at first, for about twenty-four hours, bright yellow, afterwards duller; in three or four days pale dull yellow, blotched pretty evenly all over with circular patches of small pale brown dots, the centre of each patch densely spotted; in about ten days the whole colouring grows duller, and there is not so great a contrast between the ground and the

spots; in about a fortnight the larva is fully formed, and can be plainly seen through the transparent shell, and it then soon eats its way out at the top of the egg, and makes its first meal of the empty shell. The young larva is dumpy in figure, stoutest in front, with round head; in colour it is very pale grey, the front segments with a purplish tinge from the internal organs showing through; a rich yellow dorsal line, two yellow lines on the side, and another just above the spiracles; the head brown, granulated all over; the usual dots jet black, furnished with very short bristles; spiracles black. In about ten days it seems to have moulted, and has become green all over, with darker green dorsal line, subdorsal line paler than the ground colour, and the spiracular line yellowish, the head brown. When the larva is about 9 mm. long its figure is stout, with the back swelling in a curve which is highest about segment 7; the head globular, rather narrower than the second segment; the tail set with two short spines; the colour all over grass green, the dorsal line darker green finely edged with yellowish; subdorsal line yellow edged with dark green, followed by a finer yellow line, then the green spiracular line, and a broad well-defined whitish-yellow subspiracular stripe; the spiracles brown. This coloration continued nearly unaltered as long as any of my larvae lived, except that in the spring the yellowish lines grew more whitish, and the head was green. (J. H., 24, 10, 85.)

#### CÆNONYMPHA PAMPHILUS.

##### Plate VI, fig. 4.

I have reared this species more than once, but can find no more record of its changes than the following notes made in 1874.

The eggs were laid by captured females 28th May,

1874, but I do not know when the larvæ were hatched. August 11th one larva had become a pupa, and the rest were about 7 mm. in length. August 22nd the butterfly appeared, whilst the rest of the brood were still larvæ, and just then passing through a moult; and these hibernated in the larva state, for on February 13th, 1875, I noted the fact that one of them was sunning itself on the covering of its cage. It seems the knowledge that Mr. Buckler had figured the larva in previous years more than once, kept me in this case, as well as in so many others, from making full notes. I may add that in 'Ent. Mo. Mag.', vol. VI, p. 223, there is a note to the effect that Von Prittitz found *Pamphilus* to be one of the species which pass the winter in the egg state; my record above does not seem to agree with this view, but then I have no note of eggs laid by the second flight of the butterflies in August.

The egg is somewhat bucket-shaped, with flattish base and top, and upright sides, broader at the base than above; the sides with nearly fifty small irregular ribs, and faint transverse reticulation, the top thimble-pitted all over, the shell glossy, pale green at first, turning in a day or two to whitish, freckled and ringed with pale yellowish-brown. The full-grown larva is about 20 mm. long, with rounded head, the body more tapering backwards than in front, the last segment with two short points; the colour a clear green, with darker green dorsal stripe, and a spiracular stripe not so dark; the anal points pink. The pupa is rather over 11 mm. in length, plump, but with the headpiece somewhat squared; the abdomen ending in a short, stout, rather flattened and curved spike, the tip of which is thickly set with curled spines, well adapted for holding on to the silk pad; the colour mostly green. (J. H., 9, 11, 85.)

The following very short note on the pupa of *C. Pamphilus* occurs in one of Mr. Buckler's Note Books (I, p. 70):

Pupa a little more than three eighths of an inch in length, smooth and plump, very slightly ridged or keeled on the back of the thorax, the superior margins of the wing-cases project on each side as a rather sharp ridge; the head rather square in outline, the back of abdomen bent round in a curve to the anal tip.

Colour a delicate pale rather yellowish-green, with a faintly darker green dorsal stripe, the edge of the projecting wing-covers on each side whitish, outlined with a streak of reddish-brown; the abdomen freckled very delicately with paler green; the tip of the anal point, with a short streak of brownish red on each side; the wing-cases faintly marked with darker green nervures.

This pupa was received April 16th, 1871, from Miss Pasley; having assumed the pupa state on the 5th of that month, suspended to a blade of glass.

#### CYNTHIA CARDUI.

Plate VIII, fig. 1 (see *ante*, p. 49).

In 1877, July 21st, Dr. T. A. Chapman kindly sent me an egg, which he had found on a thistle, after watching the parent butterfly settle on it for oviposition; unfortunately after taking a description I injured the egg, and so lost the chance of seeing the young larva. In 1885, July 21st, I had the pleasure to receive from Mr. W. H. B. Fletcher, of Worthing, six larvae nearly full grown; they were feeding on *Onopordon acanthium*, the leaves of which they fastened together by some tough silken threads, and they seemed to eat out the thick fleshy parts of the leaves very voraciously. The first became a pupa on July 21st and the rest within a week; the butterflies appeared between 1st and 4th of August. On August 17th Mr. Fletcher wrote that he had lately seen two pairs

of the butterfly *in cop.*, so that no doubt there has been a second brood, or partial brood, this year. Mr. Fletcher also informed me that he has found the larva feeding on flowers of *Echium vulgare*.

The egg is stout and somewhat barrel shaped, with sixteen sharp edged, longitudinal ribs coming over the edge of the top, in the centre of which is a large circular plain spot; the transverse reticulation crosses the ribs and knobs them; the colour of the shell is dark green, the ribs are pellucid. The full-grown larva is about 32 mm. long, stout, with large horny head set with bristles, the face being rather long. There are seven rows of short, bluntnish spines set with bristles, and they are arranged as follows: eight in the dorsal row on segments 5 to 12, ten in the subdorsal row on segments 3 to 12, eleven in the lateral row on segments 3 to 13, and nine in the subspiracular row on segments 5 to 13; there are also fascicles of hairs on segments 2, 3, and 4, and a row of them just above the legs; the body generally is sparsely set with hairs. As to colour I had two varieties, the darker having the ground colour blackish, slightly freckled on the back with yellowish, the dorsal line, which is interrupted by the dorsal spines, is in colour velvety black edged with sulphur yellow; there is a sort of subdorsal pale line made by the small freckles being set closer together in that part, then comes a black space edged below with a waved yellow line; next comes a slightly freckled black line bearing the spiracles which are black ringed with yellow, and below that is a clear, broad yellow line; there is a black, shining plate on segment 13; the spines on segment 3 black, all the others pale yellowish, set with blackish bristles, the other hairs pale; the belly dark grey with a reddish streak above each leg, all the legs reddish-brown; the paler variety had the ground colour of a dull greyish drab, the dorsal line of the ground colour on a more yellowish band, the lateral lines more distinct, the spines pinkish with whitish tips.

The pupa is suspended by the tail, it is about 22 mm. in length, stout, and though following the usual *Vanessa* pattern, more rounded in its form; the head has a pair of very short, blunt horns, the back of the thorax swells up in a round curve, with a short blunt spike in the middle, and falls in at the waist; the abdomen swells out a little and then curves away regularly to the tail; the belly outline is much less curved, the anal spike is like a short curved leaf-stalk ending abruptly, and is set round with a ring of hooked spines; down the back there is a middle row of six blunt knobs, and a subdorsal row of nine on each side. I had two varieties of coloration; the darker variety had the back pale dusky brown finely dotted with black, down the middle of the back an interrupted stripe of pale pinkish grey glossed with gold, the subdorsal knobs golden, and outside them on the abdomen a stripe of pinkish grey; on the under side the wing-cases brownish somewhat marked with the pinkish-grey tint, the antenna-cases darker and more smoky, the abdomen mostly pinkish, but with central and lateral stripes more smoky; on the under side of the head a pale, square spot, and short pale lines running out to the short horns; the paler variety had all these same markings, but the dusky portions much less extensive, and the general colouring greenish with a golden glossing or lustre. (J. H., 28, 10, 85.)

#### VANESSA ATALANTA.

#### Plate VIII, fig. 2.

I have not many records of this species; perhaps one of my most pleasant entomological memories is that of seeing the butterfly in good condition flying about during a gleam of sunshine on the morning of Christmas day, 1866; at last it settled on a child's shoulder, and was an object of admiration for some

time. In 1883 I found some larvæ in their caves formed by drawing together the leaves of *Urtica dioica*, but I have not the exact date of this, or of similar finds in other years. On July 25th, 1885, Mr. W. H. B. Fletcher kindly sent a number of the larvæ of various sizes, feeding on nettle (Mr. Fletcher informs me he has before now found the larva on *Parietaria officinalis*); a large proportion of them developed ichneumons when rather more than half grown, but several became pupæ between July 28th and August 10th; the first butterfly emerged August 8th, and the rest during the month. The smaller larvæ were mostly black, but so many were killed by ichneumons that I got but few notes of them. The full-grown larva is over 30 mm. long, stout, the head horny, with a flat face, much larger than the second segment, which is both short and narrow; the body is set with seven rows of branched spines (longer than those of *C. cardui*, but not so long as those of *V. Io*), arranged as follows: eight dorsal on segments 5 to 12, ten subdorsal on segments 3 to 12, twelve lateral on segments 3 to 13 (there are two pairs of lateral spines on 13), and eight subspiracular on segments 5 to 12; the head set with glistening warts; and there are some on the second segment, and a few hairs all over the body. The colour seems very variable. I had some examples which I called black—the ground colour being blackish, freckled and dotted with white, with two pale yellow lateral stripes, the upper one being much narrower than the lower; the spines on segment 3 black, on segment 4 yellow with black tips, all the other spines pale yellow; the thoracic legs black, ventral prolegs reddish-brown, anal prolegs black with yellow feet; the spiracles indistinct, being black ringed faintly with yellow on black ground, below them a stout waved yellow line; the belly black speckled with whitish. Another variety was soft grey in general colour, with the spines buff; another, grey freckled with yellowish-green, with darker marks along the subdorsal region, and a yellow sub-

spiracular stripe; others again were dark-brownish, with the dorsal and subdorsal spines pale, and the rest black; and some dark ones had all the spines black; one dark variety had the ground colour sooty brown, lighter at the segmental folds, and darker in rings as it were on the ridges of the segmental subdivisions, with minute pale yellow dots, the bases of all the spines clear ruddy brown, the spines and bristles glistening black; the spiracles blackish, inconspicuous, the subspiracular yellow stripe reduced to a series of yellow blotches just at the segmental folds, so that half of each blotch was on one segment and half on the next, no other lines; the head sooty brown with glistening black warts; thoracic legs shining black, ventral and anal prolegs brown, the feet pink.

The larva suspends itself for pupation in its cave; the pupa, suspended by the anal spike, is about 24 mm. long, stout, of the *Vanessa* figure but somewhat rounded; the head with a pair of very short horns, the back of the thorax rising to a point and then falling in rather sharply to the waist, the abdomen swelling out in a bold curve to the tail; there is a dorsal row of six very small knobs, and a subdorsal row of nine knobs, not so blunt as in *C. cardui*; the shoulders of the wing-cases rising into two angulated points; the contour of the belly nearly straight, but the abdomen curves in a little, the anal spike stout like a leaf stem, a little flattened, curved under, the flat tip set with a mass of very short, hard, black curved bristles; the colour is a uniform soft grey, most delicately freckled with a darker tint, and somewhat glossed with golden; the dorsal knobs are golden but small, the subdorsal knobs are larger spots of gold, the largest being those at the waist; there is a large golden spot on each side of the belly of the segment in which the wing-cases end, the anal spike dark, the narrow spiracles pale brownish. Albin, who must have been lucky with parasites, says he found some of these pupæ gilded all over, and that they produced a brood of small but

very beautiful ichneumons; all my examples that became pupæ produced butterflies. As mentioned above it was when about half grown the larvæ were killed off by parasites. (J. H., 29, 10, 85.)

## VANESSA IO.

## Plate VIII, fig. 3.

On July 7th, 1881, I took some larvæ on stinging nettle, *Urtica dioica*, which moulted for the last time July 10th, and became pupæ July 16th—20th. In 1885, July 4th, I found some larvæ as yet without spines, but they presently moulted before I took any notes of their appearance. On July 6th I found another family just passed the same moult; after this they moulted twice, viz. July 7th and 8th, and July 12th—14th; they became pupæ July 20th—22nd, and I bred the butterflies August 1st—3rd. I know nothing of the egg, but the whole batch must be deposited together, for the larvæ are found feeding together in families; they are irritable when disturbed, both walking quickly and flinging about their heads, and ejecting from their mouths a dark greenish fluid. When the larva is about 13 mm. long, before the last moult but one, it has the full complement of six rows of spines, but they are very short, the spiracular and subspiracular rows being scarcely more than high warts; the skin is shining, dingy brown, showing reddish at the segmental divisions, with faint indications of the white dots. With the last moult but one the spines grow much longer and stronger, and the colour becomes velvety black, and the transverse rows of little white dots become distinct. When about 22 mm. long the larva moult for the last time, but does not then change its appearance much; the full-grown larva is about 36 mm. long, rather slender, the segments well marked, head wider than the second segment, and set with

warts ; the spines are quite 3 mm. long, pointed and set with bristles, in the subdorsal row there are ten on segments 3 to 12, in the spiracular row eight on segments 5 to 12, in the subspiracular row seven on segments 6 to 12, and on 13 there are two pairs placed nearly in line with the subdorsal rows ; the general colour is velvety black, the dorsal line and the segmental folds are dead black, the head, the plate on segment 2, and the anal plate, are all shining black, there is also a small dorsal plate on segment 12 ; the subdividing rings of the segments have on them transverse rows of white dots, the two hinder rings of each segment bearing more than the others, the spines are black (immediately after a moult they are whitish, and being strongly contrasted with the dark skin are easy to count), the fine hairs on the head and back are pale, those lower down are brown ; the true legs are black, the ventral prolegs are pale purplish with the feet yellowish, the anal prolegs black with pale feet ; the spiracles large, but being black are inconspicuous.

For pupation the larva suspends itself head downwards from a little pad of silk, and hangs for a couple of days in a curved posture, but at length straightens itself ; the actual change is the more interesting to watch from the contrast between the green of the new pupa skin, and the intense black of the old skin of the larva. When matured the pupa is over 25 mm. long, stout, and mostly cylindrical, though a little angulated, the skin wrinkled ; on a side view the back outline is much curved, the belly much less so ; the head has two triangular diverging horns, the back of the thorax rises in an abrupt curve, and has in the middle a short spike ; it falls in at the waist, whence the abdomen goes in a long curve to the tail, and is set with subdorsal rows of six spines on each side, the first blunt, and the other five sharp ; the shoulder of the wing-case has a short spine, and there is another lower down on the edge of the wing-case ; the abdomen ends in a long

stem-like spike, the sides of which are ribbed and thicker than the middle, and its tip is set all round with a great number of tiny hard black bristles curved like hooks, and which radiate regularly outwards in every direction. In colour I had two varieties, one pale greenish-yellow, the other pale grey, but freckled all over with smoky black and so looking dingy ; in both varieties the inner sides of the horns, the tips of the spines, and the sides of the anal spike, are outlined in black, and the lower parts of the spines are tinged with reddish ; there is a metallic lustre, especially in the pale variety, on the first blunt pair of the subdorsa spikes, and on two pairs of blunter humps on either side of the thoracic dorsal spike. The wing-cases and antenna-cases in both varieties are marked out by lines of freckles. Albin says he found pupæ gilded all over, which produced small ichneumons, but I have not myself found any of this species so infested. The winter is passed by this species in the butterfly state, and the eggs are laid in May. (J. H., 6, 10, 85.)

## VANESSA URTICÆ.

Plate IX, fig. 2.

(See ante, p. 55.)

I have nothing to add about this species, except the fact that I have occasionally found its pupa gilded nearly all over, and looking very brilliant, but as far as I know this appearance is caused by the presence of parasites.

I have carefully described the egg of this species, and also that of its congener *Polychloros*, in the 'Ent. Monthly Mag.', vol. VIII, p. 53. (J. H., 6, 10, 85.)

## GRAPTA C-ALBUM.

## Plate IX, fig. 3.

(See *ante*, p. 57.)

With this species in its earlier stages I had no acquaintance until this autumn, when on September 18th Mrs. Hutchinson kindly sent me a pupa, and next day Miss Preston Decie sent me two larvæ feeding on hop; and this small supply was obtained with difficulty, some enterprising collector having circulated advertisements in the local papers of the hop-growing districts in Herefordshire and Worcestershire, as well as posting placards in the villages, to offer to take all the larvæ and pupæ the hop-pickers could find, at a certain rate! The two larvæ became pupæ on September 25th and 26th respectively. At the time of my present writing all three pupæ show signs of the butterfly being nearly ready to appear. Mrs. Hutchinson tells me the latest date for its emerging which she has known is November 5th. (On examining the cage again I find one butterfly just out.)

The full-grown larva is about 34 mm. long, cylindrical, the segments well cut; the head is horny with the face quite flat, each lobe armed with a short horn, the tip of which is set with hard warts; the second segment about as wide as the head, with a transverse row of bristle-bearing warts; the other segments bear seven rows of branched spines in the following order: eight dorsal on segments 5 to 12; twelve subdorsal on segments 3 to 13, both pairs on 13 may be said to belong to this row; ten lateral on segments 3 to 12, and eight spiracular on segments 5 to 12; the dorsal spine on each segment is in advance of, and the subspiracular spine behind the others. The ground colour is black dotted with red, the head black; the second segment has a fine red dorsal line; segments 3 to 6 have each a transverse red patch on the back, and the

subdivisions lined in red, and their dorsal and subdorsal spines red ; then comes on segments 7 to 11 a broad dorsal band of white, with a dusky blackish dorsal line, and some short black streaks ; here the dorsal and subdorsal spines are white ; on 12 this white band ends in a wedge shape ; 13 is black but its spines are white ; the lateral row of spines all red, the subspiracular row pink ; the spiracular region is marked with an upper and lower waved red line, with a red slanting streak behind each spiracle connecting the two ; the spiracles are conspicuous, being black ringed with white ; belly blackish with some red-brown marks, legs blackish. The larvæ suspended themselves for pupation from the under side of a hop leaf ; the pupa, suspended by the tail, is 20 mm. in length, and very contorted in figure ; the head is rather flat, and has two straight horns, 1 mm. long, pronged at their tips ; the back of the thorax rises up sharply to a thin squared central projection, and then falls in again abruptly ; the waist hollowed ; the abdomen rising in a bold curve to the tail, with its centre line marked more by colour than prominence ; there is a subdorsal row of nine small knobs, of which the two below the waist are the highest ; the wing-cases are prominent, their shoulders angulated with two flattened projections, and their lower ends humped, and standing up from the abdomen ; the belly contour is straight from the head to the end of the wing-cases, where it falls in, and the abdomen follows the curve of the back to the anal spike ; this is long, stem-like, and a good deal curved under, the tip thickly set with curled spines. The colouring reminds one of the wings of *Plusia gamma* and *iota*, being purple brown with a pink tinge ; there is a pinkish-grey line down the middle of the back of the abdomen, and on six of its segments slanting marks forming v's with their points towards the tail ; in the waist three pairs of silver spots, the first with a dark dot in the silver ; the other subdorsal knobs tipped with reddish ; along the spiracles a rich brown stripe,

narrowing towards the tail ; a pair of dark dashes on the under side of the thorax, and a dark diamond pattern down the abdomen ; the spike outlined in pink and brown lines. The pupa received from Mrs. Hutchinson was darker than the others, but seemed to have been injured. (J. H., 31, 10, 85.)

### THECLA BETULÆ.

#### Plate XII, fig. 4.

This species is not at all so common in the neighbourhood of Exeter as *Th. Quercus*, and although I have for several years taken the larva in May and June, yet all the examples I have seen if put together would not equal the numbers of *Quercus* taken in a single season of average productiveness ; its food-plant, the blackthorn (*Prunus spinosa*), does not ordinarily grow except in hedges, and no doubt the clipping and trimming it there receives keeps down the number of larvæ that come to perfection. This year (1885) I could not find an example, but Mr. G. C. Bignell worked very hard for me in the neighbourhood of Plymouth, and at last obtained one larva, which reached me on June 12th ; it was then not quite 9 mm. long, 3 mm. wide, and its colouring not very different from the final appearance, but the skin was more glossy though covered with fine pubescence. On June 18th it moulted ; the cast skin was not eaten. After this it seemed to thrive for a time, and grew larger, but I do not think it attained perfect growth, and at last it began to shrink again, and died about the middle of July.

On June 29th, whilst it was still thriving, I described it as follows : length about 14 mm., greatest width  $4\frac{1}{2}$  mm., namely, at the fifth segment, where it also measured 4 mm. in depth from the dorsal ridge to the belly, at that segment a transverse section would be triangular ; the belly flat, through segments 5 to 13 the sides slope from the dorsal ridge down to the subspira-

cular ridge like the roof of a house, from segment 4 forwards the back widens out, the segments deeply cut, the head dark, small, and quite retractile under the second segment; the skin generally dull, but shining along the middle of the back, thickly covered with very short pubescence; along the dorsal ridge a double row of longer stiffer bristles, and a single row of them along the subspiracular ridge; the colour generally a bright light green; two lines of pale yellow, being in fact two rows of short streaks, commence on segment 2, where they are widest apart, drawing nearer through 3 and 4, and from thence running parallel along the back; the subspiracular ridge has a yellow line edging it, which goes all round the anal flap, but on 2 stops where it meets the dorsal yellow lines; on each segment from 5 backwards are two rows of small yellow streaks slanting downwards and backwards; on 4 there is only the upper streak, none on 2 and 3; about the middle of the streak in the lower row comes the oval spiracle outlined with brown on a raised round whitish spot; belly and legs more whitish green; the hinder pairs of trapezoidal dots can be detected, not easily, being paler than the ground; the coloration gives the effect of a double dorsal ridge, but this is not so really. I have no account of the pupa. (J. H., 1, 10, 85.)

## THECLA QUERCUS.

## Plate XIII, fig. 2.

Ever since I began to collect I have been accustomed to get larvæ of this species from oaks in May and June, but never from any other tree, although I have seen the butterflies sporting about and settling upon the ash. In 1877 Mr. Bignell sent me an egg which he had watched the butterfly deposit on a sallow leaf. I suppose the larva is hatched in spring, but am not sure; it is full fed (according to the character of the season) from the end of May to near the end of June,

and the date of my first imago varies I see from 23rd June (1865) to 15th July (1867); this year (1885), after a great deal of hard work, I got one larva on June 9th, just in its last moult, and Mr. Bignell beat out two on June 11th. We were disappointed at not getting more, but the early summer was very cold and backward, and many larvæ must have been killed; two of these larvæ hid themselves for pupation June 14th to 18th, and I bred the perfect insects July 14th to 16th. The egg is of the shape common to the *Lycenidae*, only larger than that of any of our Blues; for instance its wide diameter compared with that of the egg of *Argiolus* is as 4 to 3, and this of course indicates a considerable increase of bulk; it is round in outline, flattened, and, with the exception of a central depression on the upper surface, covered with irregular oblong reticulation, the lines of which, much more prominent on the top than with any of the Blues, on the sides become so exaggerated that at the knobs they stand out like spines, and the egg looks quite like a rough *Echinus* in miniature; the under surface, which rests on the leaf (or stem), is only granulated; the shell under the reticulation apparently has a very pale pinkish-brown tinge; the lines of the reticulation are whitish.

The smallest larva of which I have any notes was 8 mm. long, just at the time of its last moult. I could not find the cast skin and thought it had been eaten. The full-grown larva was 16 mm. long, and not quite 5 mm. wide; its figure is generally called onisciform, but I know Mr. Buckler had come to reject this term except for the larva of *C. Phœas*; he thought the flattened lateral ridge rendered the similitude inexact. The head is small, rounded, and entirely retractile into and under the second segment; viewed from above the second segment is the longest and tapers to the head; the width is almost even from segment 3 to 12, but 12 is a little narrower than the rest, 13 is much narrower and tapers off roundly in almost a circular curve; viewed sideways the back arches in a curve, highest at

segments 5 and 6; the segments are strongly divided, each sloping forward so that the back edge of the next rises like a notch, except between 2 and 3, for 3 rises higher than 2 at its front edge; 11 and 12 are also less distinctly divided. Below the spiracles each segment is produced into a flattened ridge, thus causing the great proportional width; the belly is flat; a transverse section of the larva would be almost triangular; all the legs are short and well under the body, the motion is even, almost gliding; the general colouring is brown; the centre of the back is fawn colour, with a dark-brown dorsal line bordered with yellowish, which looks like a groove; the second segment is edged with yellowish, and has a central brown spot in front with a greyish patch; the third has a semicircular brown patch with its curve behind; the fourth has a similar patch, but smaller; on each of segments 3 to 10 there is in the subdorsal region a pale streak slanting downwards and backwards edged below with very dark brown, growing wider and more intense backwards; these streaks map off the centre of the back; below them the side is darker than the back, the edge of the ridge is yellowish; some way above the ridge are the round, small, dark brown spiracles, placed in a hollow. On segments 11 and 12 the centre of the back is brown, the sides yellowish, the hinder part of 12 chestnut; 13 has a small squarish chestnut patch at the tip, bordered with yellowish-white; the colour under the ridge is reddish-brown, just above the legs is a pale line; centre of the belly blackish; true legs black and shining, with a fringe of bristles along them on the outside, the prolegs soft pale brownish-ochreous.

For pupation the larva spins a few threads, making a frail sort of cocoon just on the surface of the earth, or availing itself of the shelter of a fallen leaf; the pupa is stout and rounded in outline, about 9 mm. long and rather more than 4 mm. at its widest, the back rounded, the belly more flattened, the abdomen not extending more than 3 mm. beyond the wing-cases,

which are rounded off short, the tail rounded off without any knob or spike ; the skin a little roughened but glossy, on both sides of the abdomen the skin is set with tiny short bristles with flat heads, like old-fashioned flat-headed pins ; the colour mahogany-red on the back, freckled with darker, and the dark slanting marks on the side of the larva seem retained, the wing-cases paler and not much freckled, under side of the abdomen reddish without freckling. (J. H., 30, 9, 85.)

POLYOMMATUS (LYCÆNA) ARGIOLOUS.

Plate XIV, fig. 1.

(See ante, p. 94.)

Mr. W. H. B. Fletcher informs me he has taken the larva of this species on flowers of *Cornus sanguinea* at Worthing. (J. H., 29, 10, 85.)

POLYOMMATUS (LYCÆNA) ARION.

(See ante, p. 104) ; one of the few larvæ of which there is no figure in this volume.

Mr. Buckler's notes on this species having been given, perhaps I may as well add the little I can to his account, in order to give all the help possible towards the full discovery of its habits.

On 28th June, 1858, I captured ten butterflies, having started for their habitat at 3 a.m. and getting home again about 10.30 p.m., the longest entomological excursion I ever made ; at that time I had no thought of rearing anything from the egg, and took no pains to watch the movements of the females ; however, on July 6th and 8th, 1865, some local collectors obtained eggs, and sent them to me, but I find no note about the larvæ, and believe that when they hatched I gave them

various vetches, which of course they would not eat, and must have soon died. In March, 1869, Professor Zeller told us in the 'Entomologist's Monthly Magazine,' vol. VI, p. 10, what his experience had been, and set us right as to the food-plant, *Thymus serpyllum*; so next year (1870), when Mr. Buckler forwarded me some eggs, June 21st, both of us felt confident the way was clear to a full knowledge of the life-history. The larvæ hatched on June 24th, and were placed on wild thyme flowers, and fed away most satisfactorily; several of them got through one moult, and then about the middle of July they all ceased feeding and died off. On 26th July I visited a locality for the species, and found traces of the larvæ having fed on several heads of thyme flowers, but could find no larvæ either on the plants or under them.

In 1872, July 1st, Mr. Merrin sent me eggs, and the larvæ hatched in two or three days, but they must soon have died, for I find nothing more noted about them; I noticed, however, on the thyme flowers a small coleopterous larva not unlike them in colour and figure. June 24th, 1873, Mr. Merrin again sent me eggs, and the larvæ began to hatch immediately, and were placed for a day or two on flowers of garden thyme, and again I noticed a little beetle larva; on July 1st came more eggs from Mr. Merrin, and by this time I had wild thyme ready for them, planted in a large flower-pot, and full of bloom; on this some of the larvæ lived till July 28th, when they were seen to be restless as if in search of something I had not given them, and after that I could note no more. On 23rd May, 1875, Mr. G. F. Mathew searched carefully the thyme plants in the haunts of last year's butterflies, but found only beetle larvæ, by this time black in colour, and similar larvæ were found by a local collector; on July 6th and 22nd, Mr. Bignell and Mr. Mathew sent me living butterflies, some of which laid eggs, but I was able to add nothing more to the notes made in previous years.

All these failures puzzled us much ; after three weeks' feeding on the thyme flowers the larvæ seemed to want something else—what could it be ? We thought of furze blossoms and tried them, but to no purpose. The localities in which the butterfly occurs differ very much in situation, some being inland, and some close to the sea, and Professor Zeller's note mentions moist open meadows at the foot of hills, and also lofty fir forests, the only point of agreement being the occurrence of *Thymus serpyllum* in all of them, except, perhaps this other characteristic, that they are all places of rather troublesome access, and therefore not easy to be thoroughly searched. Of late years too, the butterfly seems dying out in England, whatever may be the cause. Professor Zeller had not long before his death promised Mr. Buckler he would make an expedition purposely to search for the larva in spring, but that hope was doomed to disappointment ; we must wait till someone can devote time to the investigation *in situ* of the problem whether the larva feeds up before winter (like *P. Argiolus*) or not till after hibernation (like *P. Adonis*), and whether there is any real ground for our surmise that there is any migration from thyme to another food-plant.

The egg seems to be deposited among the flowers of *Thymus serpyllum*, it is circular in figure, and flattened, covered all over, except a central depressed spot on top, with fine raised, irregular reticulation, which in profile stands out strongly ; colour of shell the blue-green of a hedge-sparrow's egg, the reticulation transparent white ; I have no measurements noted, only the comparison that it is thrice the bulk of the egg of *P. Alsus*.

The newly-hatched larva is a stumpy, plump little fellow, with small head ; at first dull greenish, but soon pinkish-brown, head black ; after a moult I found it about 4 mm. long, and more purple in colour. (J. H., 9, 10, 85.)

## POLYOMMATUS (LYCÆNA) CORYDON.

## Plate XIV, fig. 3.

All that I know of this species is given in the account of *Adonis*, see *ante*, p. 109, and I can only repeat here that both Mr. Buckler and myself took the utmost pains to examine and describe the larvæ of *Adonis* and the single one of *Corydon* there mentioned.

## POLYOMMATUS (LYCÆNA) ALEXIS.

## Plate XV, fig. 2.

(See *ante*, p. 111.)

On 29th April, 1865, I found a nearly full-grown larva on *Lotus corniculatus*, and sent it to Mr. Buckler, and on 27th July of the same year Mr. H. Doubleday sent me several larvæ on *Ononis arvensis*, from which I bred the butterflies August 15th to 19th. On August 25th, 1875, I watched a number of the butterflies laying their eggs on *Lotus corniculatus*, the axil of a leaf being the spot generally selected, and some of these eggs I secured; the larvæ began to appear August 30th and fed away through the next month, and I have a note that on February 5th, 1876, I had one larva more than half grown, but this afterwards died, its companions apparently having died previously to the date of that note. On June 10th, 1885, I caught a ♀ butterfly, and enclosed her in leno over a plant of *Lotus corniculatus*, and on the 12th, finding she had laid a few eggs, I let her go again. The larvæ were hatched June 23rd, and were all kept on their food-plant out-of-doors; three or four of them outstripped the rest in growth, and moulted at the beginning of July, and again on July 12th. I could not be certain of the dates of further moults, but there was one about July 20th; these larvæ became full fed

about July 27th, and by the 29th two had become pupæ, and two others a day or two later, and I bred the butterflies on August 15th; meanwhile the other larvæ, though treated just in the same way, had grown much more slowly, and were not half grown when these butterflies appeared; afterwards one of them grew more quickly and became a pupa, September 22nd, in which state it now remains; the rest died. These notes are meagre enough, but they seem to show that the winter is passed in the larva stage, and that through the summer the succession of broods may be irregular. The egg is much like those of all our Blues which I have been able to examine, circular, rather flat, being just  $\frac{1}{2}$  mm. in width, and less than half that measurement in height; the shell is dull, covered on the sides and just over the edge of the upper surface with raised reticulation, having projecting knobs at the knots; this reticulation becomes finer and less prominent on the upper surface, which has a central depressed spot; this spot is green, while the general ground colour is greenish-white, and the reticulation glistening white. The larva makes its escape by eating a large round hole in the centre of the upper surface of the egg, but leaves the rest of the shell untouched, and for some days in feeding only eats into the substance of a leaf of *Lotus corniculatus*, either from the upper or the under side, leaving the opposite skin as a white spot, but it can eat the flower entirely. The newly hatched larva is not quite 1 mm. in length, of dumpy figure, the head very small, the second segment as wide as, and longer than, any of the others, and having a semicircular plate with its rounded edge in front, down the back a row of transverse pits on the front edge of each segment; the general colour grey with purplish tinge, the segmental divisions green, the belly yellowish; the usual dots black on grey warts, and furnished each with a rather long, curved, glistening bristle; the whole skin besides is finely sprinkled with tiny black dots; the head

shining black, the plate on the second segment rather darker than the ground ; the spiracles black. When about  $1\frac{1}{2}$  mm. long it passes the first moult, not eating the cast skin, and is now pale olive drab all over, the usual dots paler than before, only outlined in black ; the bristles have increased in number, some being short and pale, others longer and darker. The larva is about  $2\frac{1}{2}$  mm. long before the next moult, and its colour is dull pale green, with a paler double dorsal line, and paler subspiracular line ; after this moult the back is pale greyish-green, with the lines on the dorsal ridges rather paler ; the spiracles round, pale brownish, inconspicuous ; the skin set with a number of small warts ; along the dorsal and subspiracular ridges are rows of long bristles, and on the sides some shorter ones. When 9 mm. long the larva is dull full green in colour, with the subspiracular ridge yellowish, the belly and legs yellowish-green, the head shining black, the spiracles green, indistinct, the bristles very pale brownish. The full grown-larva is 12 or 13 mm. long, and nearly 4 mm. wide, the head small, and under the second segment, which is flattened, the other segments slope from the subspiracular ridge up to the double dorsal ridge, the last three sloping down also to the tail ; the segmental divisions deeply cut, the whole skin finely set with tiny hairs ; the colour a dark full green all over, the dorsal ridges paler, the subspiracular ridge yellowish, the sunken spiracles pale green, the head shining black. None of my larvæ have spun any girdle for supporting themselves in pupation, although they went up to the cover of their cage for that change ; and when it took place the cast larva skin remained fixed, whilst the pupa had fallen down. The pupa is nearly cylindrical though rather wider than deep, rounded at the ends, 10 mm. long and 4 mm. wide across the abdomen ; the back of the thorax rises with a round curve, and drops a little at the waist, the abdomen going in a curve to the tail ; the wing-cases rounded, the pupa skin, especially at

the wing-cases, very delicate and shining; colour generally pale green, head pale brownish, wing-cases with a very faint brown tinge, a dark green line down the middle of the back of abdomen, the spiracles whitish, a few short bristles scattered on the skin. (J. H., 7, 10, 85.)

Dr. R. C. R. Jordan informs me that he often found this species hibernating as a larva when he was in Devonshire; specially on one occasion when, in company with Mr. Stainton, he was searching for cases of *Coleophora discordella* on *Lotus corniculatus*. I am the more glad of this corroboration because *Alexis* has been said to hibernate in the egg, and again as a pupa; and Dr. Jordan thinks that in colder localities this last view represents the true state of the case. (J. H., 31, 10, 1885.)

#### STEROPES PANISCUS.

#### Plate XVII, fig. 1 (see *ante*, p. 129).

The larvæ, which Mr. Buckler figured and described, came into my possession in February, 1884; I found them hibernating in their silken caves among the growing blades of the plant of *Brachypodium sylvaticum*, on which he had reared them, and for the purpose of taking them with me I was obliged to cut off these caves and put them in a tin box, and in so doing I may have disturbed their rest. On bringing them home I placed the caves on a fresh plant of the grass, which stood in my window enclosed in a glass cylinder, and before long the larvæ left them and walked about the grass, until they all got to the top edge of the cylinder or its gauze covering, and there, after doing a little spinning, they fastened themselves by their tails, and with a silken belt round the middle, and became pupæ during the second and third weeks of March. I suppose this may be their natural habit,

but as I never saw the larvæ eat anything, I doubted whether they ought to have left their winter quarters at all, and whether they should not have turned to pupæ in their caves. The first butterfly appeared on April 30th.

The length of a larva after hibernation was about 20 mm., the ground colour pale creamy white, dorsal line pale reddish-brown, subdorsal line yellowish edged on each side with reddish-brown, the spiracular line also of the same colour; the small spiracles distinct brown; the head slightly tinged with blackish, the mouth dark brown.

The pupa is 15 mm. long, slender, nearly cylindrical, the head blunt and the eyes rather prominent, with a sharp spike more than 1 mm. long between them; the back swelling up on the thorax with a gradual curve, and falling away again in the same manner, so that the back of the abdomen is almost hollow, but curving up again at the tail; the wing-cases reaching about two-thirds of the full length; the anal end rounded, but with a flat spike set at the tip with a dozen or more curled spines of different lengths; the colour on the back creamy white, with a very dark brown thin central line from the head spike nearly to the tail, a subdorsal line of pale buff bordered with reddish-brown, and then a shorter buff line edged below again with reddish-brown; the wing-cases and ventral surface pale flesh colour faintly tinged with dusky, the straight tongue-case dark brown. (J. H., 10, 11, 85.)

#### PAMPHILA LINEA.

Plate XVII, fig. 3 (see *ante*, p. 139).

In 1865, July 29th, Dr. Knaggs sent me eggs of this species laid in a row in folded grass, but how he managed to get the butterfly to lay them I do not know; the larvæ hatched on August 12th; most of

them soon disappeared, but one survived till the middle of November ; it was then only about 2 mm. in length, so I must have mismanaged it. In July and August of 1875 and 1876 I caught a number of the butterflies, and confined them, but could not induce them to part with a single egg ; at last in 1876 I took some recently dead butterflies and carefully squeezed the eggs through their ovipositors, and in each case the egg which *first* came out proved fertile, but no more. The larvæ began to hatch on August 15th, they soon spun little ropes of silk across the blades of grass, and made little web coverings for themselves, but they would not feed, and an accident soon after befel their cage, and I saw them no more.

The egg is not at all like that of *P. sylvanus*, but is considerably smaller, of a long oval figure, half as long again as wide, the shell glistening, devoid of ribs or reticulation ; at first white, then turning dull yellowish, and at last paler again with the dark head of the larva showing through. The young larva eats part of the empty egg-shell ; in shape it is slender, cylindrical, even in bulk, the head longer than the second segment but scarcely wider ; the skin very smooth, no bristles except on segments 2 and 13, and some very short ones on the head ; colour pale dull yellow, with a faint dorsal vessel ; head dull pale brown, and a faint brownish crescent-shaped collar on the second segment. (J. H., 25, 9, 85.)

#### PAMPHILA SYLVANUS.

Plate XVII, fig. 4 (see *ante*, p. 141).

In 1875, June 26, I caught and confined several butterflies, some of which laid eggs about July 1st, and the larvæ were hatched July 13th ; they chose cock's-foot grass for food, and rested in the middle of a blade, fastening its edges across with five or six dis-

tinct little ropes of white silk. August 5th two of these larvæ were about 12 mm. long, and were then feeding on couchgrass; of these I have no further record. In 1876, July 13th, butterflies were again caught, and soon laid eggs, the larvæ from which hatched on July 26th. On August 13th a larva was measured, it was about 12 mm. long. On August 23rd the larvæ had not increased in length, but were grown stouter, and were spinning hiding places for themselves among the grass blades. On November 16th they were found to be all resting in close fitting, long and narrow, tough silken hibernacula; the larvæ, which had been put upon garden riband-grass, spun among the withered blades, but those, which had been living on narrower grasses, spun in folds of the leno covering of their cage. May 11th, 1877, I found the larvæ moulting for the last time, and I believe the full fed larvæ were sent to Mr. Buckler.

In confinement the butterflies laid their eggs openly and singly, but I suppose in freedom would lay them within a grass sheath. The egg is large, nearly globular with flattened base, some examples a little depressed on top; the shell is dull and finely granulated, and covered all over with extremely faint blunt hexagonal reticulation, with finer reticulation just on the top; colour dull white, afterwards tinged with yellow. The young larva eats all the empty eggshell but the base. I have no note of its size, but its skin is rather puckered, the head large and smooth, stuck on like a large flattish button; the usual dots very small, set with the very shortest bristles I ever noticed in a young larva, giving the larva a very bare look; the colour is pale yellowish, the dots black, the head and a narrow collar on the second segment are brilliant jet black; no anal plate; the four bristles on the 13th segment are somewhat longer than the rest. At the end of three weeks the larva is about 12 mm. in length, colour now dull green, head and a thin curved collar shining black. At this time it spins together the

edges of the grass blades, and makes an opaque web not much bigger than itself for a hiding place. After hibernation, in May, its size is noted as 25 mm. in length, the figure viewed from above nearly even in width, tapering a little at segments 2 and 13, but viewed sideways it tapers in a curve considerably from segment 8 to 13, which last is flattish, and forward again to 2, which is the smallest segment; the head is like a knob, but the lobes are divided; the ventral surface is flat. Altogether the appearance is plump. The colour is now pale green, the skin thickly covered with *very short* dark brown bristles, the head dirty white, with dark brown stripe down the outer edge of each lobe, the neck whitish-green. I have no notes of the fullgrown larva or pupa. (J. H., 25, 9, 85.)

#### PAMPHILA COMMA.

(One of the few larvæ of which there is no figure in this volume, see *ante*, p. 142.)

On 24th August, 1867, Mr. Brown, of Cambridge, sent me a few eggs of this species. I kept them out-of-doors, and on 27th March 1868, I found the larva eating his way out of one of them. He was so slow about it, that I had to attend to something else before he got out, and when I was able to attend to him again he had managed to disappear. The only value of this note therefore lies in this, that it indicates the habit of the species to hibernate in the egg. (J. H., 12, 11, 85.)

The following list of parasites, bred from the larvæ or pupæ of British Butterflies, has been kindly forwarded by Mr. G. C. Bignell, F.E.S.—H. T. S.

HOST.	PARASITE.	By whom Bred.
<i>Gonepteryx rhamni</i>	<sup>1</sup> <i>Limneria vulgaris</i> , Tschek..... <sup>2</sup> <i>Mesochorus gracilentus</i> , Brischke	G. C. Bignell. Bignell.
<i>Pieris brassicæ</i> .....	<sup>3</sup> <i>Hemiteles fulvipes</i> , Gravenhorst... <sup>4</sup> <i>Mesochorus aciculatus</i> , Bridgman	Bignell. Bignell.
" <i>rapæ</i> .....	<sup>5</sup> <i>Apanteles glomeratus</i> , Linné ... { <sup>6</sup> <i>Hemiteles fulvipes</i> , Gravenhorst... <sup>7</sup> <i>Mesochorus aciculatus</i> , Bridgman	Bignell and others. Bignell. Bignell.
" <i>Daplidice</i> ...	<sup>8</sup> <i>Apanteles glomeratus</i> , Linné ... { <sup>9</sup> <i>Apanteles rubecula</i> , Marshall..... <sup>10</sup> <i>Pieromalus puparum</i> , Swed. ....	Bignell and others. Bignell. Bignell.
<i>Hipparchia Janira</i>	<sup>11</sup> <i>Exorista vulgaris</i> , Fallen..... {	Bignell, J.E. Fletcher.
" <i>Tithonus</i>	<sup>12</sup> <i>Anomalon xanthopus</i> , Schrank ...	G.F. Mathew.
<i>Cynthia cardui</i> ...	<sup>13</sup> <i>Apanteles nothus</i> , Reinhard.....	Bignell.
	<sup>14</sup> <i>Rhogas tristis</i> , Wesmael .....	Bignell.
	<sup>15</sup> <i>Limneria exareolata</i> , Ratzeburg...	Bignell.
	<sup>16</sup> <i>Pimpla diluta</i> , Ratzeburg ..... { <sup>17</sup> <i>Bracon variator</i> , Nees.....	O. G. Barrett, Bridgman. F. N. Pierce.

<sup>1</sup> This parasite forms its cocoon within the larva, and so constructs it that the skin of the larva is made to do duty for an extra protection.

<sup>2</sup> Hyperparasite on *Limneria vulgaris*.

<sup>3</sup> and <sup>4</sup> are hyperparasites on *A. glomeratus*.

<sup>5</sup> The young larvæ of *P. brassicæ* are often attacked before the first moult, 'Entomologist,' vol. xviii, p. 326. 142 bred from one larva, 'Ento.,' vol. xvi, p. 263.

<sup>6</sup> A solitary parasite on larva not half grown.

<sup>7</sup> One of the *Chalcididae* bred from the pupa.

<sup>8</sup> A dipteron, sometimes escaping from the larva, at others forming a pupa within the pupa of the victim.

<sup>9</sup> Pupa from Baklar, Turkey. The parasite has been captured in Devonshire by Bignell, and bred from a *Noctua* by Bridgman.

HOST.	PARASITE.	By whom Bred.
<i>Cynthia cardui</i> .....	<i>Apanteles emarginatus</i> , Nees .....	Pierce.
<i>Vanessa Atalanta</i>	<i>Amblyteles armatorius</i> , Forster, J. R. .... <i>Hemiteles fulvipes</i> , Gravenhorst...	T. A. Marshall. J. B. Bridgman.
	<i>Limneria cursitans</i> , Holmgren {	H. M. Golding- Bird, Mrs. Norgate.
	<sup>10</sup> <i>Mesochorus sylvarum</i> , Haliday ...	Bignell.
	<i>Microgaster subcompletus</i> , Nees {	H. M. Golding- Bird, Mrs. Norgate, J. Hellins, and others.
„ <i>urtice</i> ...	<i>Limneria unicincta</i> , Gravenhorst <i>Apanteles spurius</i> , Wesmael ..... <i>Pteromalus puparum</i> , Swed. .....	Bignell. Bignell. R. M. Sotheby.
<i>Grpta C.-Album</i> ...	<i>Pimpla flavonotata</i> , Holmgren ... <i>Pteromalus puparum</i> , Swed. .....	W. H. Harwood. Harwood.
<i>Argynnис Paphia</i> ...	<i>Amblyteles homocerus</i> , Wesmael... <sup>11</sup> <i>Hemiteles melanarius</i> , Gravenhorst	Bignell. F. C. Lemann.
<i>Melitaea Artemis</i> ...	<sup>12</sup> <i>Apanteles Bignellii</i> , Marsh..... <i>Apanteles spurius</i> , Wesmael ... {	Bignell. Bignell, Robson, and others.
<i>Thecla betulae</i> .....	<i>Agrypion slaveolatum</i> , Gravenhorst <i>Campoplex pugillator</i> , Linné..... <i>Campoplex eurynotus</i> , Förster, A.	Bignell. T. Eedle. Eedle.
„ <i>W.-Album</i> ...	<i>Perilitus scutellator</i> , Nees .....	V. R. Perkins.
<i>Polyommatus Alceus</i>	<i>Limneria sordida</i> , Gravenhorst { <i>Mesochorus confusus</i> , Holmgren...	W. H. B. Fletcher. Fletcher.

<sup>10</sup> Hyperparasite on *M. subcompletus*.

<sup>11</sup> This is often a hyperparasite. In this instance it was a direct parasite, and 2 ♂ and 16 ♀ were bred from a pupa.

<sup>12</sup> The larvae from which these were bred were found by a gentleman at Ebberly, near Roborough, N. Devon, 4½ miles from Great Torrington.

# INDEX.

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<small>PAGE</small>		<small>PAGE</small>
Acis, <i>Polyommatus</i> ( <i>Lycæna</i> )		Corydon, <i>Polyommatus</i> ( <i>Ly-</i>
foot-note	xvi	<i>cæna</i> ) . . . . .
Actæon, <i>Pamphila</i> . . . . .	135	191
Adippe, <i>Argynnus</i> . . . . .	65	Cratægi, <i>Aporia</i> , figured Plate
Adonis, <i>Polyommatus</i> ( <i>Ly-</i>		II, fig. 1; but no descrip-
cæna)	106	tion.
Ageria, <i>Lasiommata</i> . . . . .	27, 163	Daplidice, <i>Pieris</i> . . . . .
Ægon, <i>Polyommatus</i> ( <i>Ly-</i>		21
cæna)	112	Davus, <i>Cœnonympha</i> . . . . .
Agestis, <i>Polyommatus</i> ( <i>Ly-</i>		35
cæna)	116, 121	Dispar, <i>Chrysophanus</i> , only
Aglaia, <i>Argynnus</i> . . . . .	71	mentioned in Preface, p. vii.
Alexis, <i>Polyommatus</i> ( <i>Ly-</i>		Edusa, <i>Colias</i> . . . . .
cæna)	111, 191	9
Alsus, <i>Polyommatus</i> ( <i>Ly-</i>		Epiphron, <i>Erebia</i> . . . . .
cæna)	100	33, 171
Alveolus, <i>Thymele</i> . . . . .	123	Euphrosyne, <i>Argynnus</i> . . . . .
Antiopa, <i>Vanessa</i> . . . . .	52	
Argiolus, <i>Polyommatus</i> ( <i>Ly-</i>		Galathea, <i>Arge</i> . . . . .
cæna)	94, 188	160
Arion, <i>Polyommatus</i> ( <i>Ly-</i>		Hyale, <i>Colias</i> . . . . .
cæna)	105, 188	16
Artaxerxes, <i>Polyommatus</i>		Hyperanthus, <i>Hipparchia</i> . . . . .
( <i>Lycæna</i> ) . . . . .	121	
Artemis, <i>Melitæa</i> . . . . .	84	179
Atalanta, <i>Vanessa</i> . . . . .	176	Iris, <i>Apatura</i> . . . . .
Athalia, <i>Melitæa</i> . . . . .	81	42
Betulæ, <i>Thecla</i> . . . . .	184	Janira, <i>Hipparchia</i> . . . . .
Blandina, <i>Erebia</i> . . . . .	30	166
Brassicæ, <i>Pieris</i> . . . . .	148	Lathonia, <i>Argynnus</i> , foot-note
C-Album, <i>Grapta</i> . . . . .	57, 182	xvi
Cardamines, <i>Anthocharis</i> . . . . .	159	Linea, <i>Pamphila</i> . . . . .
Cardui, <i>Cynthia</i> . . . . .	49, 174	139, 195
Cassiope, <i>Erebia</i> . . . . .	33, 171	Lucina, <i>Nemeobius</i> . . . . .
Cinxia, <i>Melitæa</i> , figured Plate		85
XI, fig. 3; but no descrip-		Machaon, <i>Papilio</i> . . . . .
tion.		1
Comma, <i>Pamphila</i> . . . . .	142, 198	Medea, <i>Erebia</i> . . . . .
VOL. I.		30
		Medon, <i>Polyommatus</i> ( <i>Ly-</i>
		cæna)
		116, 121
		Megæra <i>Lasiommata</i> . . . . .
		165
		Napi, <i>Pieris</i> . . . . .
		20, 156
		Pamphilus, <i>Cœnonympha</i> . . . . .
		172
		Paniscus, <i>Steropes</i> . . . . .
		129, 194
		Paphia, <i>Argynnus</i> . . . . .
		58
		Phlæas, <i>Chrysophanus</i> . . . . .
		91

	PAGE		PAGE
Polychloros, Vanessa . . . . .	54	Sibylla, Limenitis . . . . .	36
Pruni, Thecla, figured Plate XII, fig. 5 ; but no description.		Sinapis, Leucophasia . . . . .	25
Quercus, Thecla . . . . .	185	Sylvanus, Pamphila . . . . .	141, 196
Rapæ, Pieris . . . . .	19, 152	Tages, Thanaos . . . . .	126
Rhamni, Gonopteryx . . . . .	145	Tithonus, Hipparchia . . . . .	167
Rubi, Thecla . . . . .	89	Urticæ, Vanessa . . . . .	55, 181
Selene, Argynnis . . . . .	73	W - Album, Thecla, figured Plate XIII, fig. 1; but no description.	
Semele, Hipparchia . . . . .	28		



**PLATE I.**

**PAPILIO MACHAON.**

1, larva after first moult; 1 *a*, after second moult;  
1 *b*, after third moult; 1 *c*, 1 *d*, 1 *e*, after fourth moult;  
1 *f*, pupa.

See pp. 1—8.

**GONEPTERYX RHAMNI.**

2, 2 *a*, larvæ when nearly full grown; 2 *b*, pupa  
attached to leaf.

See pp. 145—148.

**COLIAS EDUSA.**

3, larva after second moult; 3 *a*, after third moult;  
3 *b*, 3 *c*, 3 *d*, after fourth moult; 3 *e*, pupa.

See pp. 9—15.







## PLATE II.

### *APORIA CRATZEGI.*

1, larva after third moult ; 1 a, 1 b, after fourth moult ; 1 d, young gregarious larva after first moult ; 1 e, after second moult ; 1 c, pupa.

There is no description of this in the volume.

### *PIERIS BRASSICÆ.*

2, full-grown larva ; 2 a, pupa.  
See pp. 148—152.

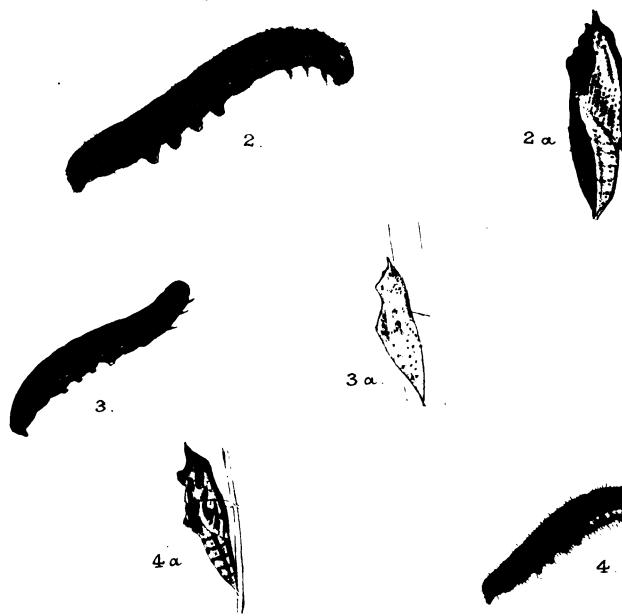
### *PIERIS EAPÆ.*

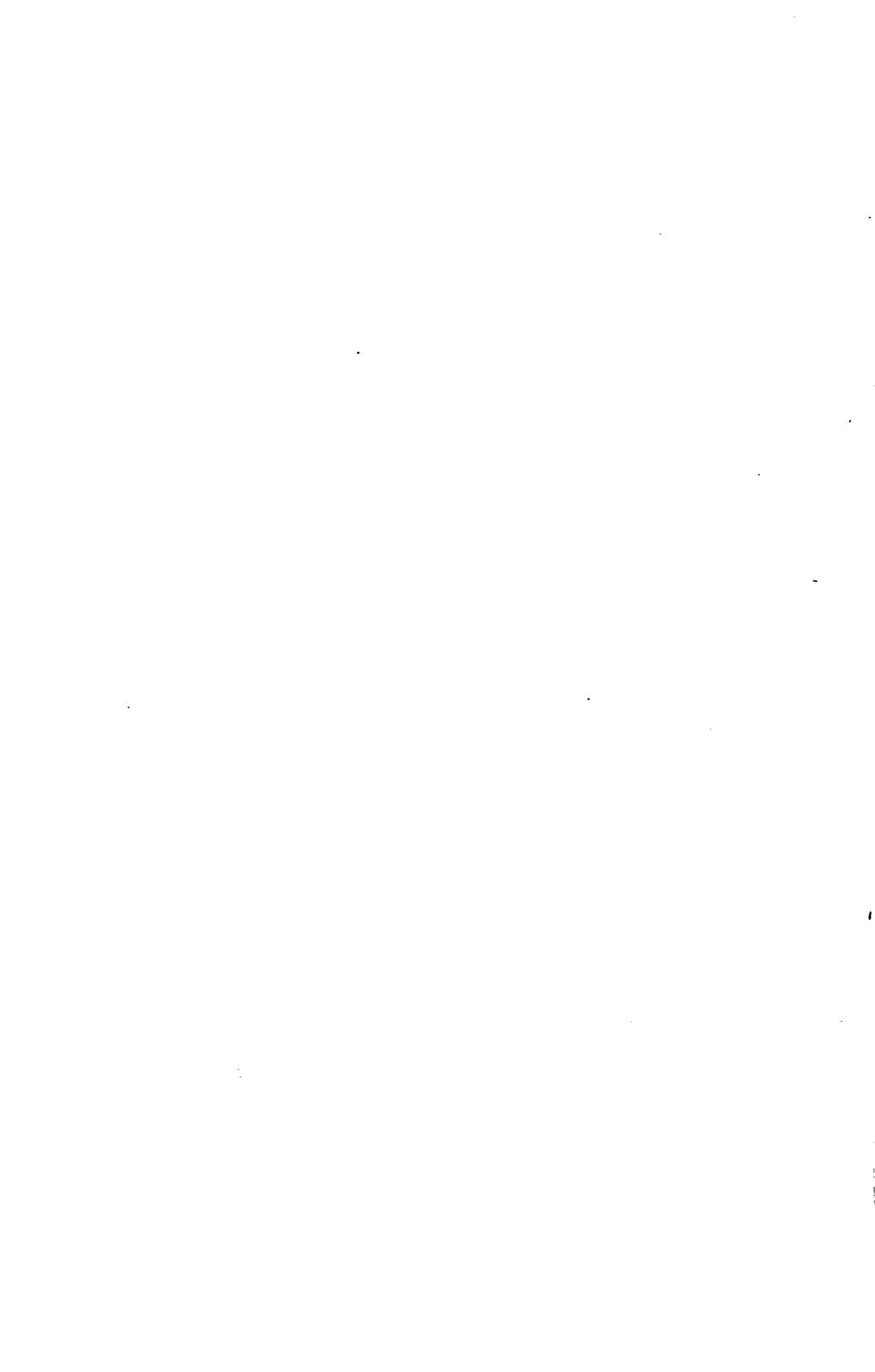
3, full-grown larva ; 3 a, pupa.  
See pp. 19, 20, and 152—155.

### *PIERIS NAPI.*

4, full-grown larva ; 4 a, pupa.  
See pp. 20, 21, and 156—159.

Plate II.







## PLATE III.

### *PIEERIS DAPLIDICE.*

1, 1 *a*, larvæ after fourth moult; 1 *b*, magnified view of a segment, the arrow indicating the direction of forward motion, and consequently which is the anterior part of the segment; 1 *c*, pupa.

See pp. 21—25.

### *ANTHOCHABIS CARDAMINES.*

2, full-grown larva; 2 *a*, pupa.

See pp. 159, 160.

### *LEUCOPHASIA SINAPIS.*

3, larva after fourth moult; 3 *a*, full-grown larva; 3 *b*, pupa.

See pp. 25—27.

### *ARGE GALATHEA.*

4 *a*, larva after third moult; 4, 4 *b*, 4 *c*, after fourth moult; 4 *d*, pupa.

See pp. 160—163.

Plate III.







## PLATE IV.

### *LASIOMMATA AEGERIA.*

1, 1 *b*, larva just after hibernation ; 1 *a*, 1 *c*, full-grown larva ; 1 *d*, pupa.

See pp. 27, 28, and 163, 164.

### *LASIOMMATA MEGÆRA.*

2 *a*, larva after fourth moult ; 2, 2 *b*, full-grown larva ; 2 *c*, pupa.

See pp. 165, 166.

### *HIPPARCHIA SEMELE.*

3, 3 *a*, 3 *b*, 3 *c*, larva after fourth moult, nearly full grown ; 3 *d*, the subterranean pupa.

See pp. 28—30.







PLATE V.

**HIPPARCHIA JANIRA.**

1 *a*, larva after third moult; 1, full-grown larva;  
1 *b*, pupa.

See pp. 166, 167.

**HIPPARCHIA TITHONUS.**

2, 2 *a*, larva after second moult; 2 *b*, 2 *d*, after third  
moult; 2 *c*, 2 *e*, after fourth moult; 2 *f*, pupa.

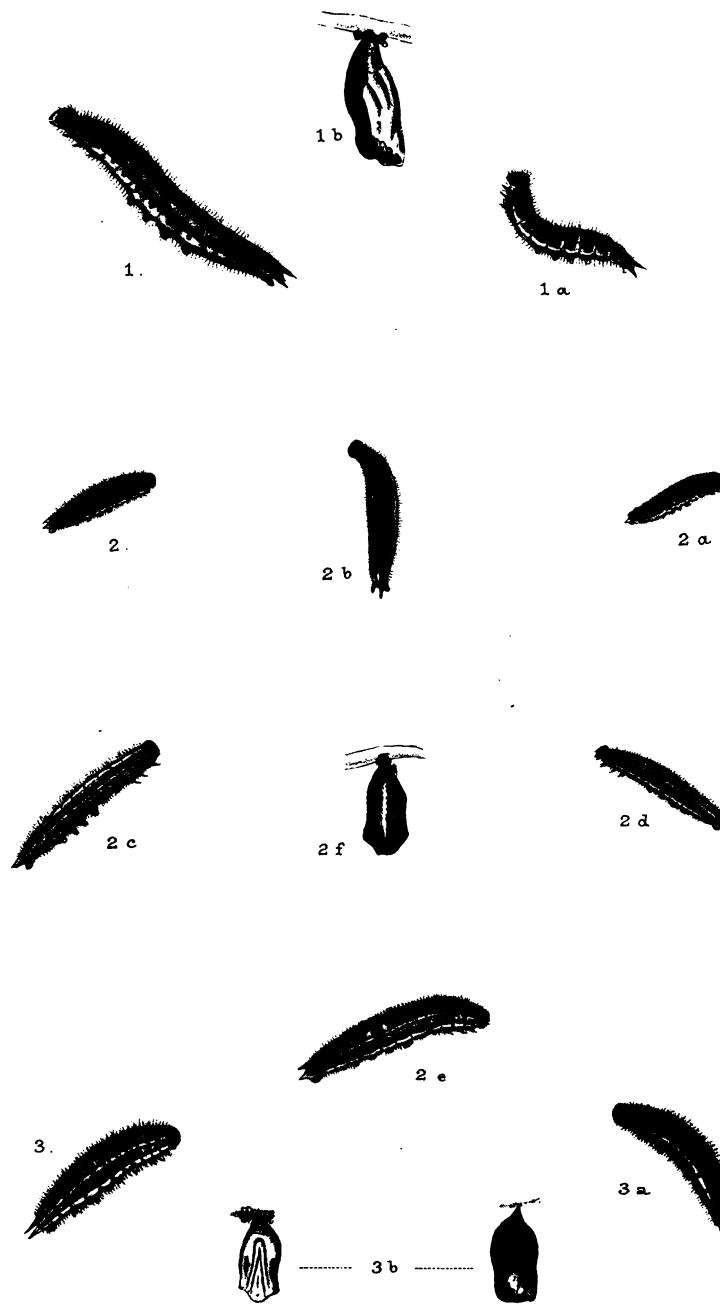
See pp. 167—170.

**HIPPARCHIA HYPERANTHUS.**

3, 3 *a*, larva after fourth moult; 3 *b*, pupa, front  
view and side view.

See pp. 170, 171.

Plate V.



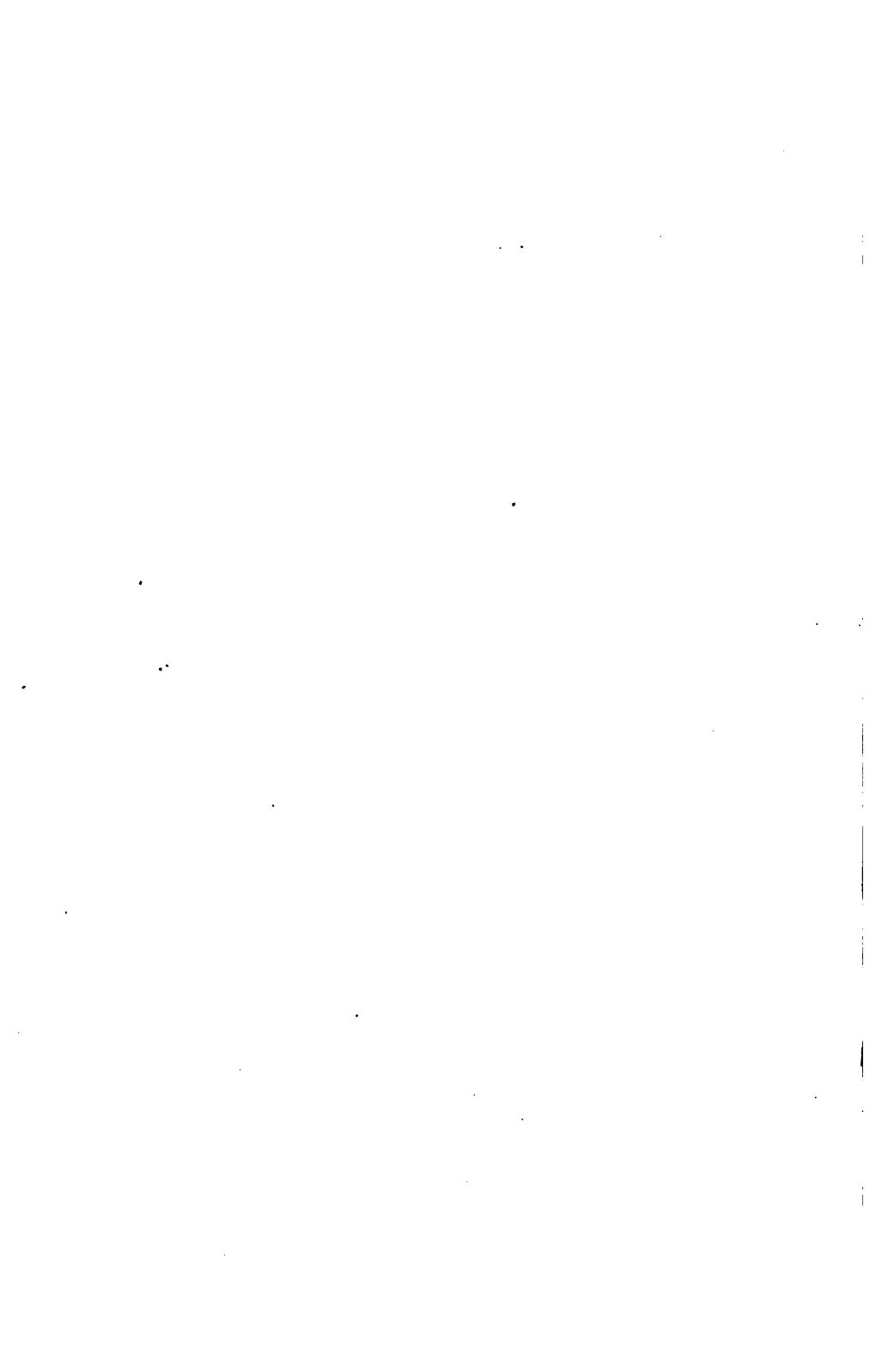




PLATE VI.

EREBIA BLANDINA (*MEDEA*).

1, 1 *a*, 1 *b*, larva after fourth moult ; 1 *c*, pupa.  
See pp. 30—32.

EREBIA CASSIOPE (*EPIPHRON*).

2, 2 *a*, young larvæ.  
See pp. 33—35, and 171, 172.

CŒNONYMPHA DAVUS.

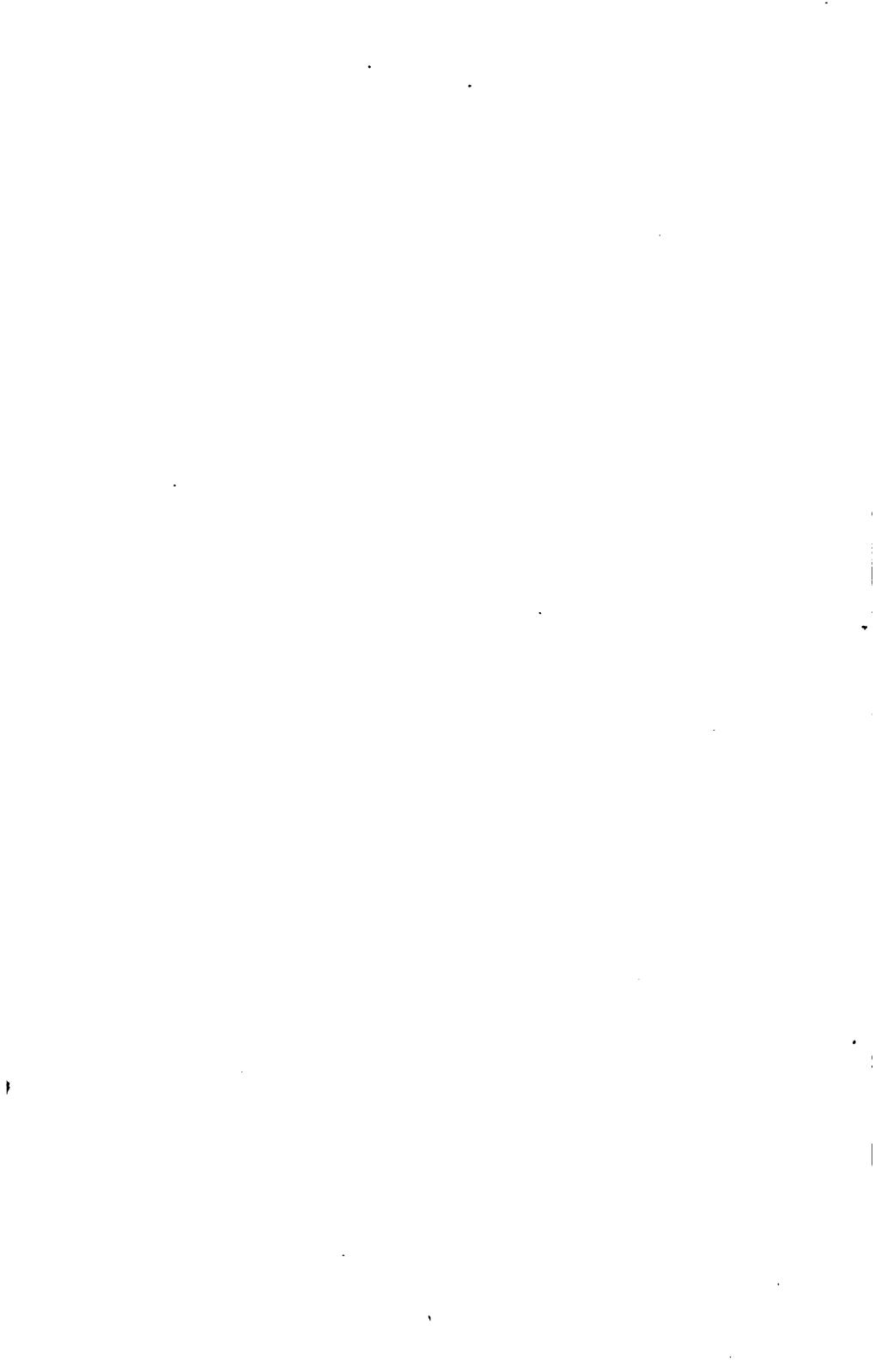
3, 3 *a*, larvæ after fourth moult ; 3 *b*, pupa.  
See pp. 35, 36.

CŒNONYMPHA PAMPHILUS.

4 *a*, larva after third moult ; 4, 4 *b*, after fourth  
moult ; 4 *c*, pupa.  
See pp. 172—174.

Plate VI.







## PLATE VII.

### LIMENITIS SIBYLLA.

1 c, twig of honeysuckle, beneath which is the hybernaculum in which the young larva has passed the winter ; above is the empty skin of the hybernated larva, and the larva as it appears after that moult ; 1, 1 a, 1 b, full-grown larva represented in three different positions ; 1 d, pupa.

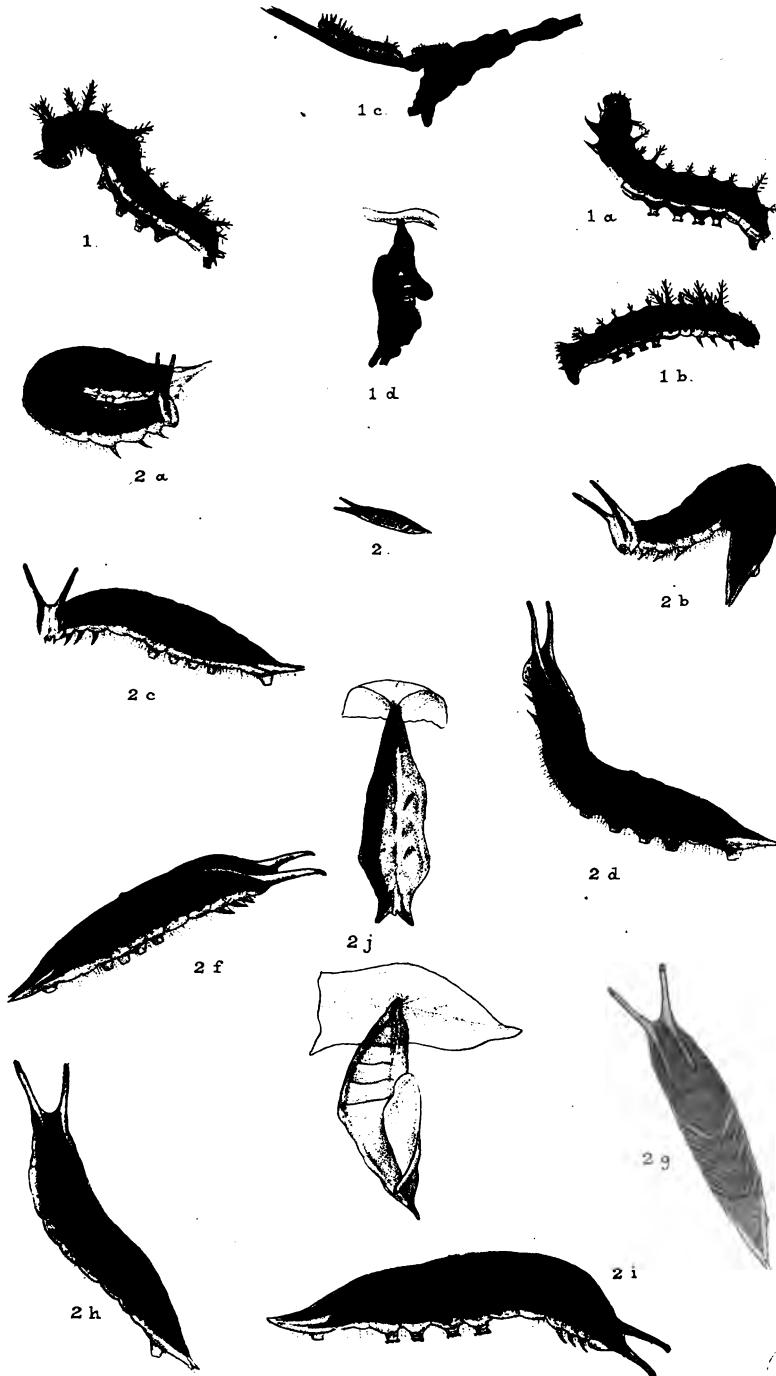
See pp. 36—42.

### APATURA IRIS.

2, larva after first moult ; 2 a, 2 b, 2 c, after fourth moult ; 2 d, 2 f, 2 g, 2 h, 2 i, after fifth moult, in different positions ; 2 j, pupa, front view and side view.

See pp. 42—49.

Plate VII.

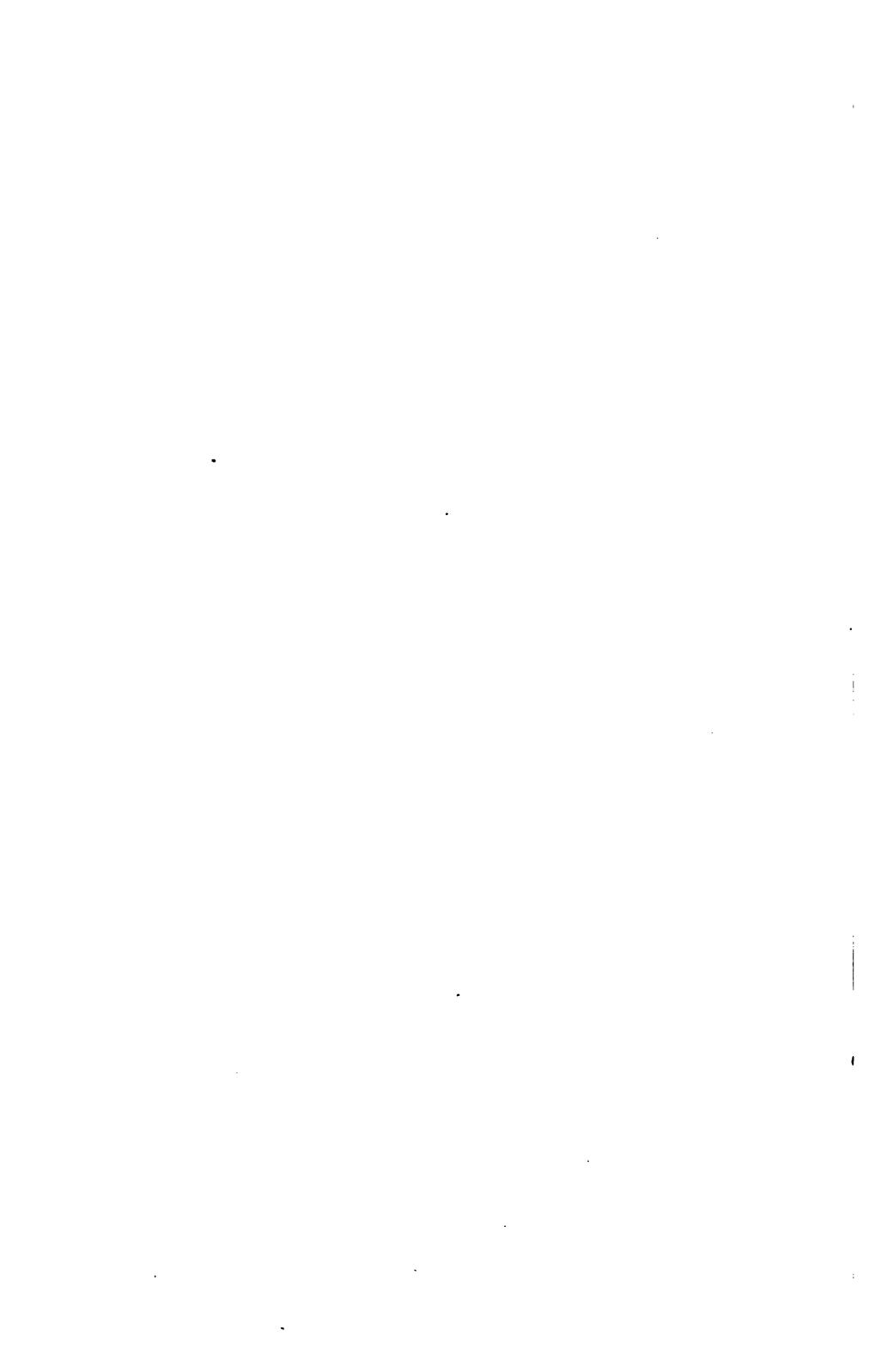


F. C. Moore lith.

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## PLATE VIII.

### CYNTHIA CARDUI.

1, 1 *a*, the ordinary thistle-feeding larva full grown ;  
1 *b*, pupa (see pp. 174—176) ; 1 *c*, 1 *d*, the hairy mallow-  
feeding larva (noticed pp. 49 to 52) after the fourth  
moult ; 1 *e*, pupa.

### VANESSA ATALANTA.

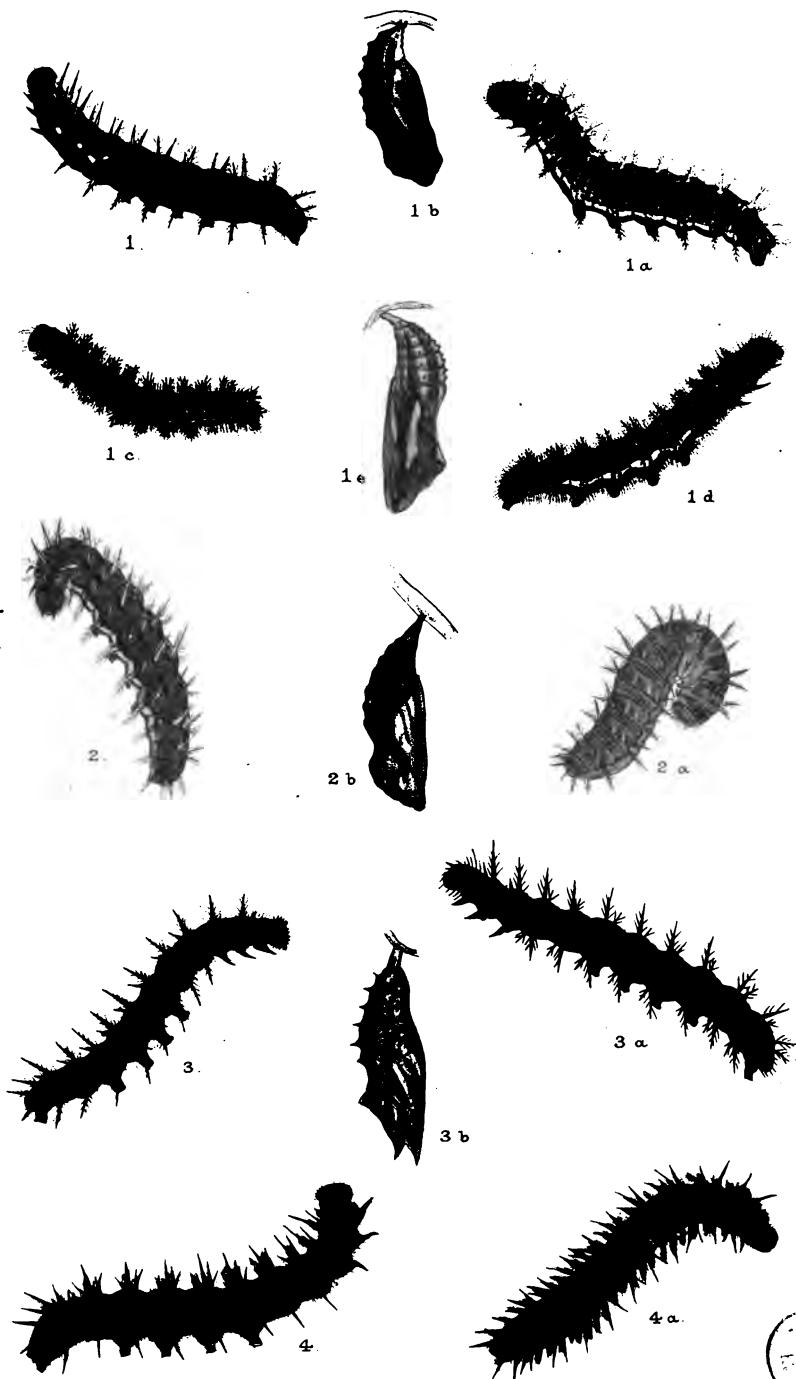
2, 2 *a*, larva when full grown ; 2 *b*, pupa.  
See pp. 176—179.

### VANESSA IO.

3, 3 *a*, larva when full grown ; 3 *b*, pupa.  
See pp. 179—181.

### VANESSA ANTIOPA.

4, 4 *a*, larva after fourth moult.  
See pp. 52—54.



F.C. Moore lith.

W.BUCKLER del.

West, Newman & C° imp.







## PLATE IX.

### VANESSA POLYCHLOROS.

1 *c*, larva after third moult ; 1, 1 *a*, 1 *b*, after fourth moult ; 1 *d*, pupa.

See pp. 54, 55.

### VANESSA URTICÆ.

2, yellow variety of larva ; 2 *a*, 2 *b*, other larvæ, all nearly full grown ; 2 *c*, pupa.

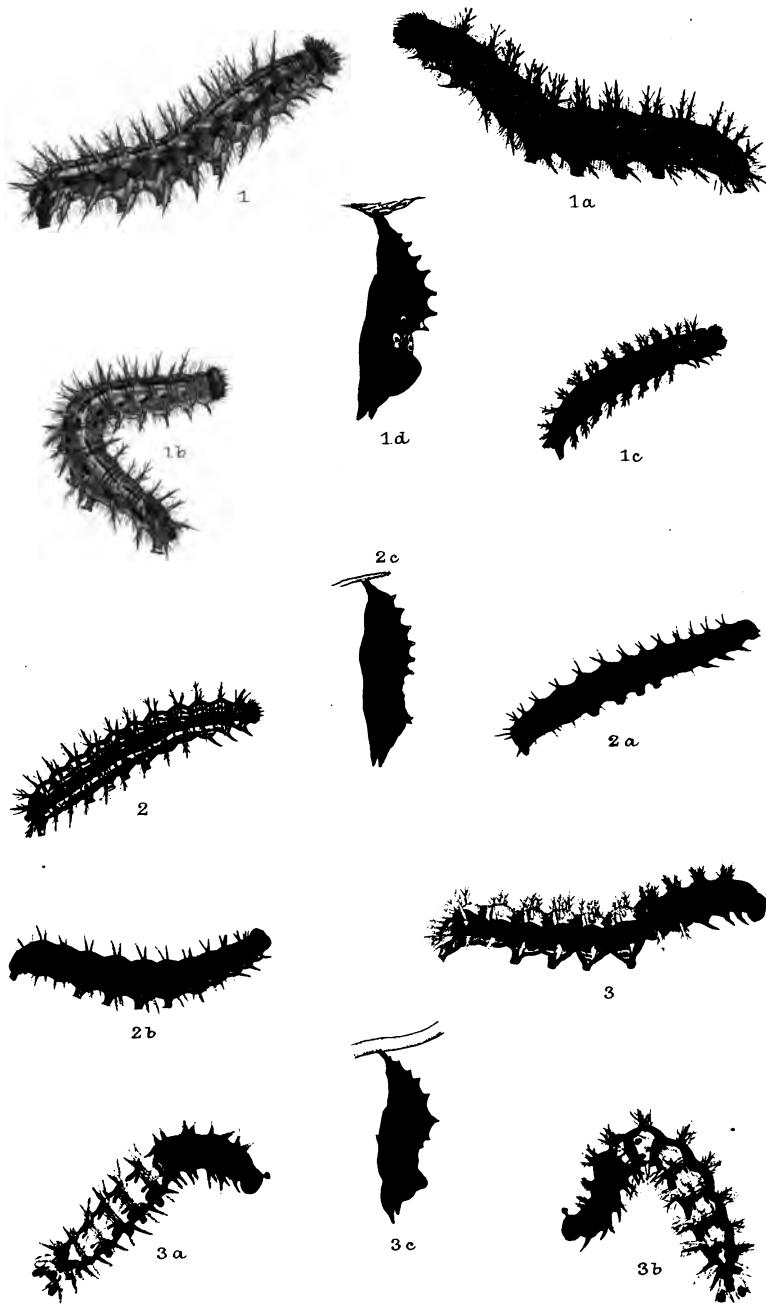
See pp. 55—57 and p. 181.

### GEAPTA C-ALBUM.

3, 3 *a*, 3 *b*, full-grown larva ; 3 *c*, pupa.

See pp. 57, 58, and pp. 182—184.

Plate IX.



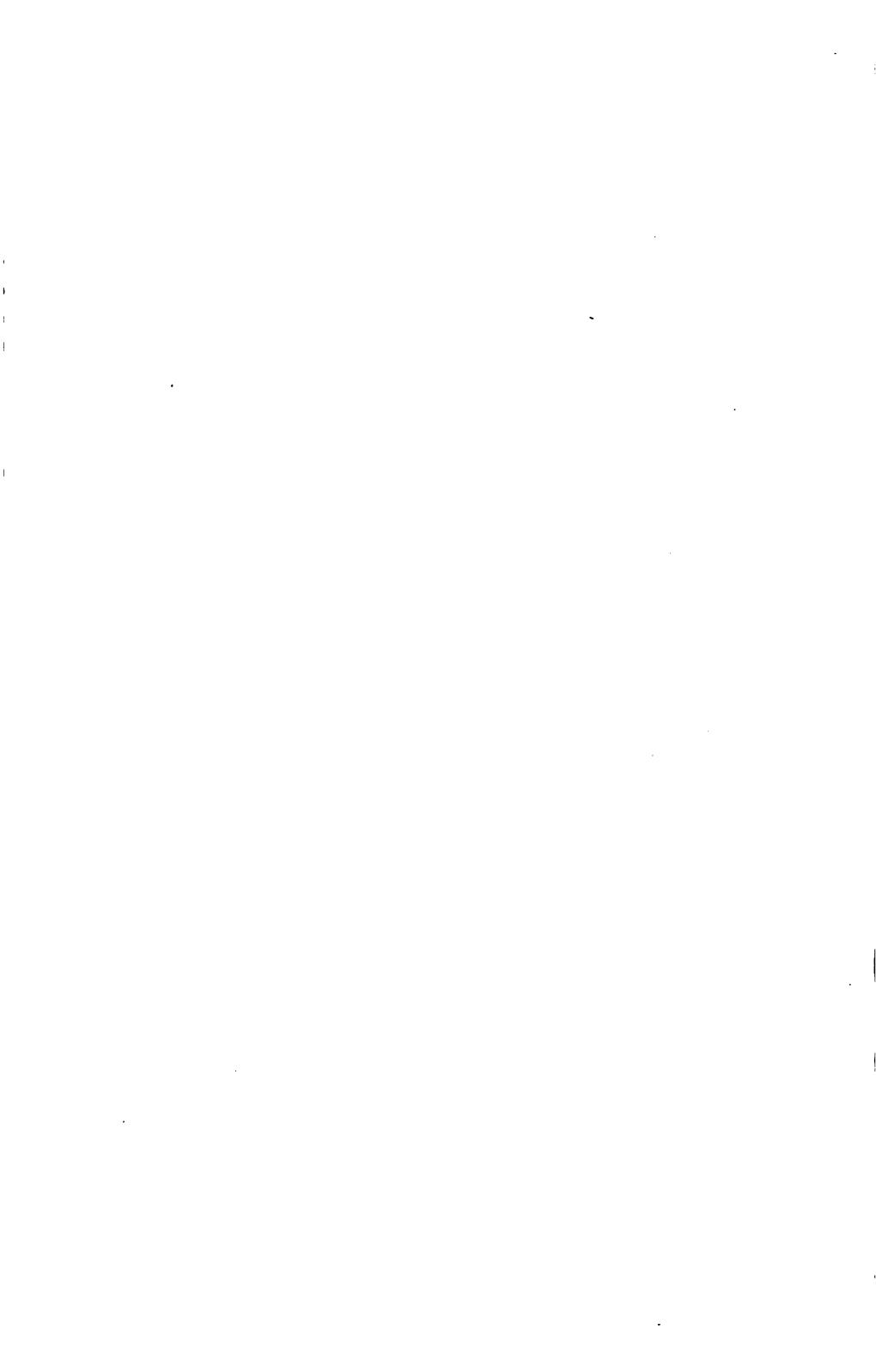




PLATE X.

***ARGYNNIS PAPHIA.***

1, 1 *a*, 1 *b*, 1 *c*, 1 *d*, larva after last moult; 1 *e*, pupa.  
See pp. 58—65.

***ARGYNNIS ADIPPE.***

2, 2 *a*, 2 *b*, 2 *c*, 2 *d*, 2 *e*, larva after last moult; 2 *f*,  
pupa.  
See pp. 65—71.

***ARGYNNIS AGLAIA.***

3, 3 *a*, larva after last moult; 3 *b*, pupa.  
See pp. 71—73.

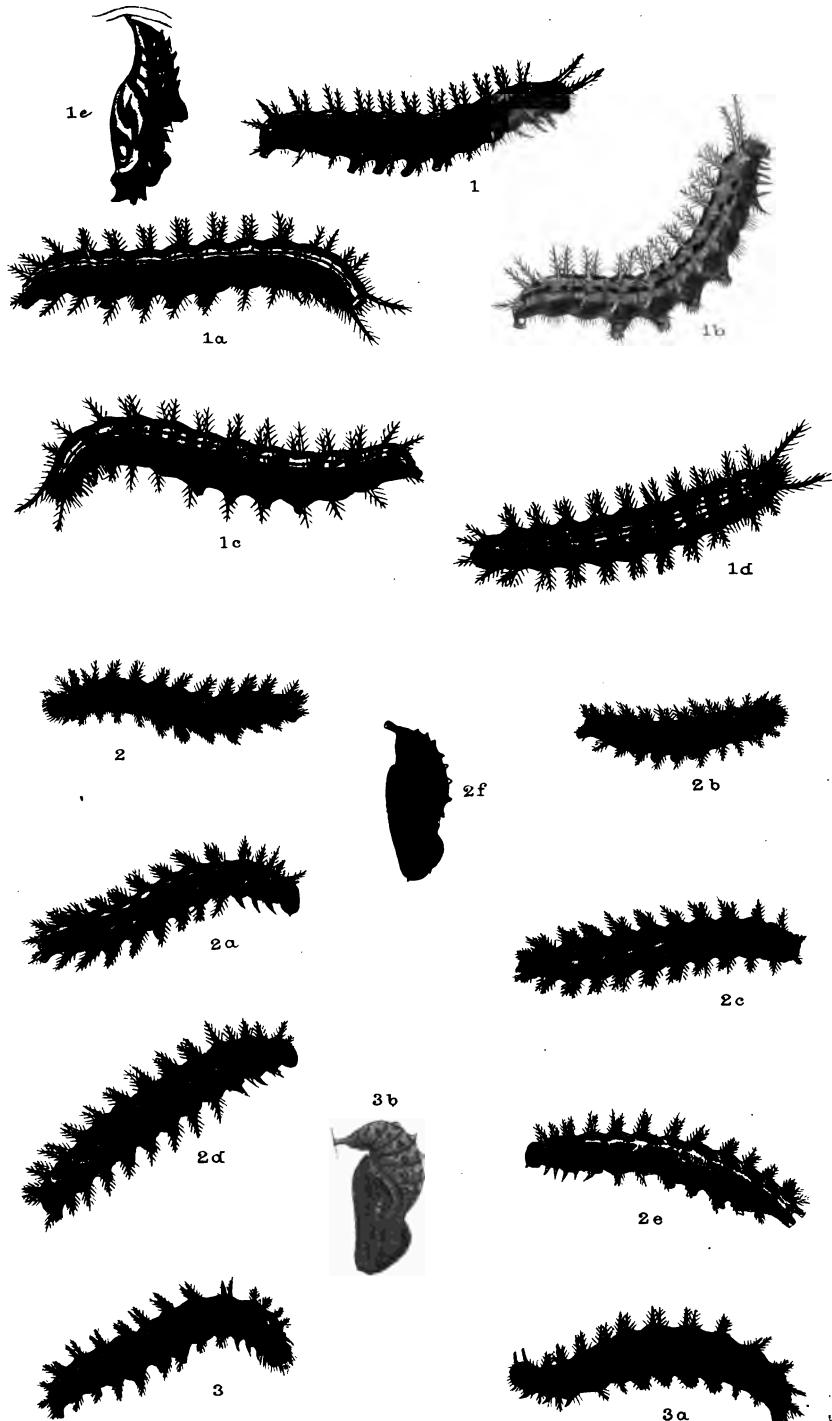






PLATE XI.

**ARGYNNIS SELENE.**

1, larva after second moult ; 1 *a*, after third moult ;  
1 *b*, 1 *c*, 1 *d*, 1 *e*, after fourth moult ; 1 *f*, pupa, side  
view ; 1 *g*, pupa, front view.

See pp. 78—77.

**ARGYNNIS EUPHROSYNE.**

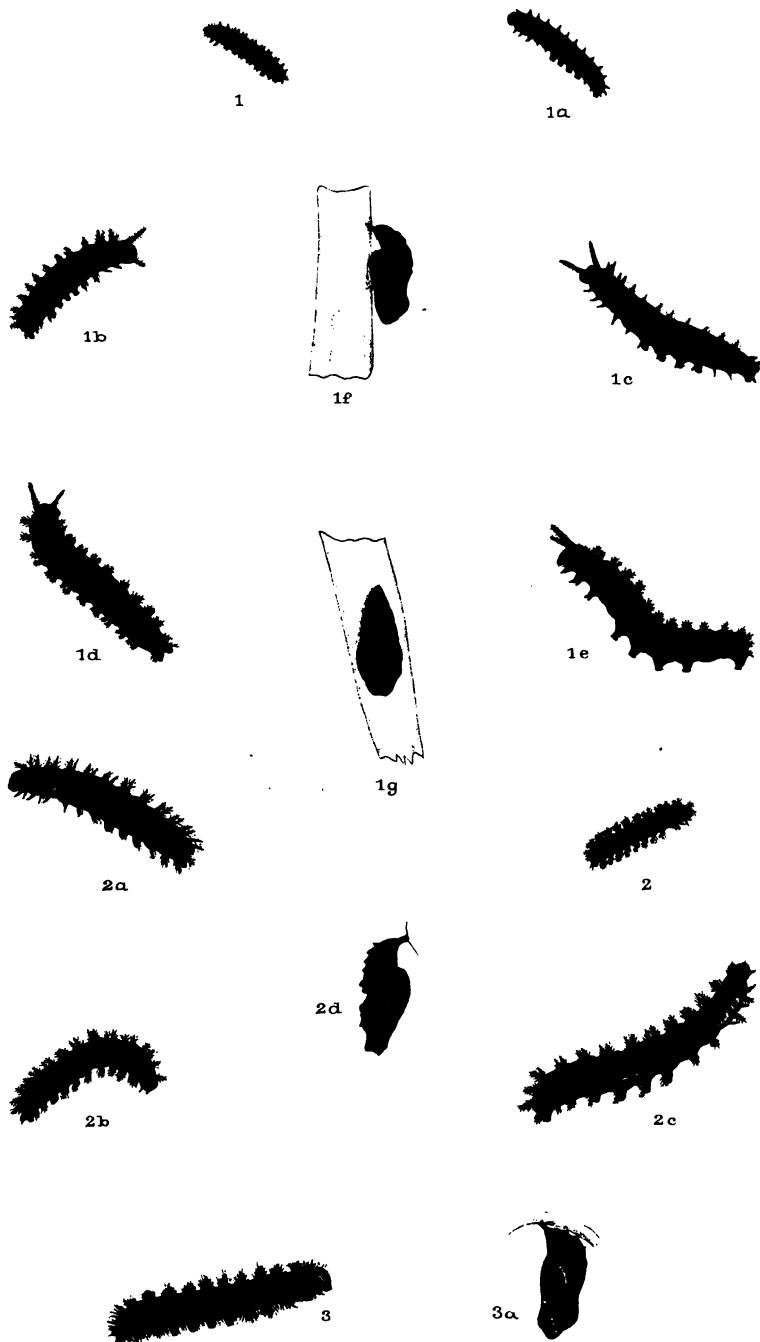
2, larva after second moult ; 2 *b*, after third moult ;  
2 *a*, 2 *c*, after fourth moult ; 2 *d*, pupa.

See pp. 77—80.

**MELITaea CINXIA.**

3, larva after last moult ; 3 *a*, pupa.

There is no description of this in the volume.







**PLATE XII.**

**MELITÆA ATHALIA.**

**1, 1 a,** larva after last moult; **1 b,** pupa.  
See pp. 81—84.

**MELITÆA ARTEMIS.**

**2,** larva after last moult; **2 a,** pupa.  
See pp. 84—85.

**NEMEOBIUS LUCINA.**

**3, 3 a, 3 b,** larva after last moult; **3 c,** pupa.  
See pp. 85—89.

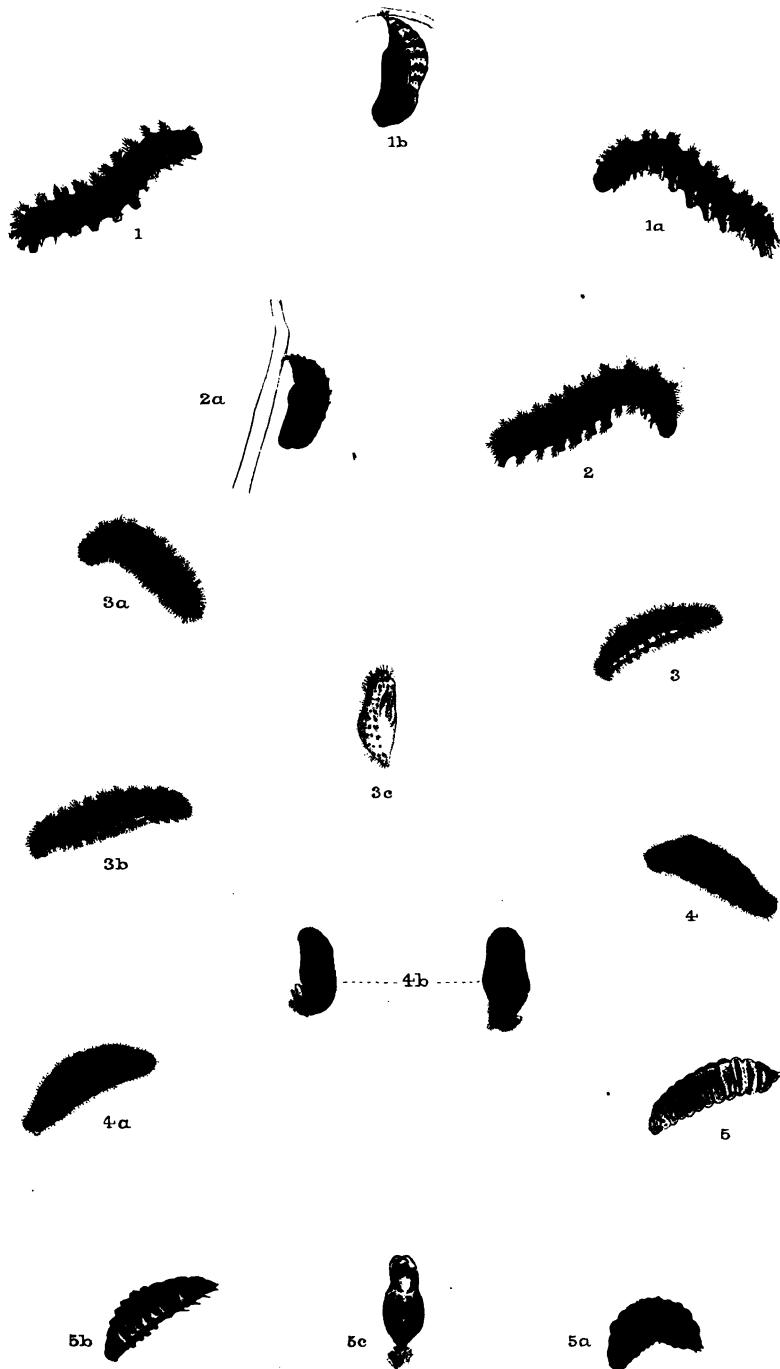
**THECLA BETULÆ.**

**4, 4 a,** larva after last moult; **4 b,** pupa, side view  
and back view.  
See pp. 184, 185.

**THECLA PRUNI.**

**5, 5 a, 5 b,** larva after last moult; **5 c,** pupa.  
There is no description of this in the volume.

Plate XII.



F.C. Moore lnd.

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## **PLATE XIII.**

### **THECLA W-ALBUM.**

**1, larva after third moult; 1 a, 1 b, after fourth moult; 1 c, pupa, side view and back view.**

There is no description of this in the volume.

### **THECLA QUERCUS.**

**2, 2 a, larva after last moult; 2 b, pupa.**

See pp. 185—188.

### **THECLA RUBI.**

**3, 3 b, larva after last moult, from broom; 3 a, larva after last moult from flowers of furze; 3 c, pupa.**

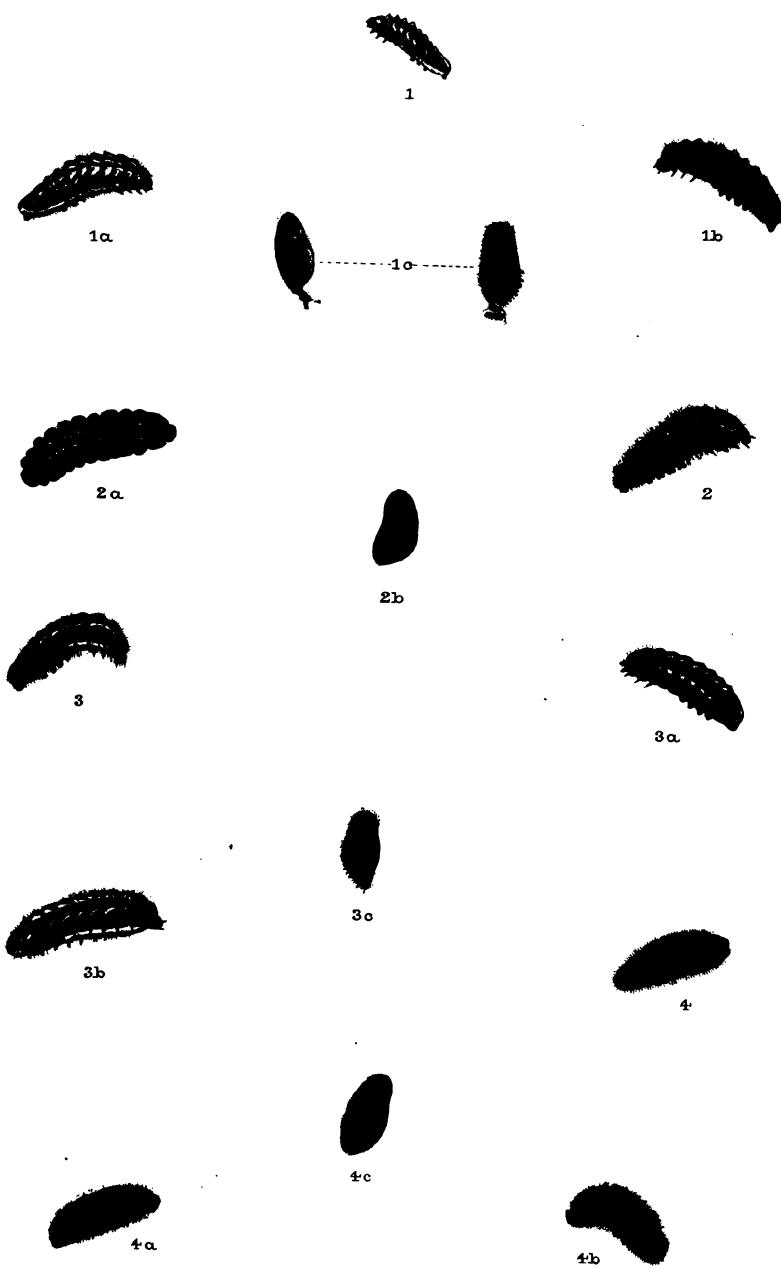
See pp. 89—91.

### **CHRYSTOPHANUS PHLEAS.**

**4, 4 a, 4 b, larva after last moult; 4 c, pupa.**

See pp. 91—94.

Plate XIII.



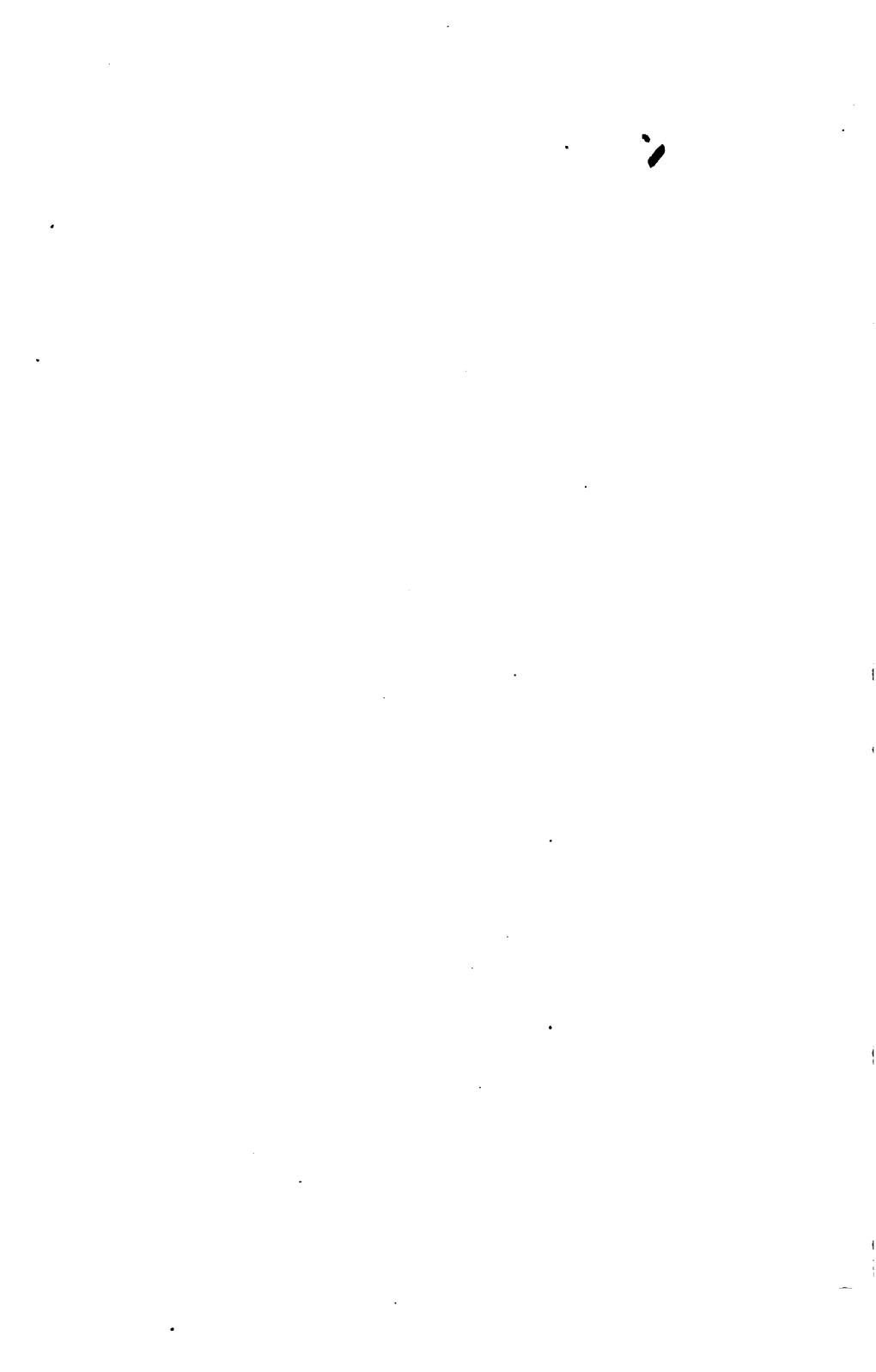
F.C. Moore lith.

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## PLATE XIV.

### POLYOMMATUS ARGIOLOUS.

1, 1 *a*, 1 *b*, larva after last moult, from holly ; 1 *c*, 1 *d*, larva after last moult, from ivy ; 1 *e*, pupa, from holly.  
See pp. 94—100 and 188.

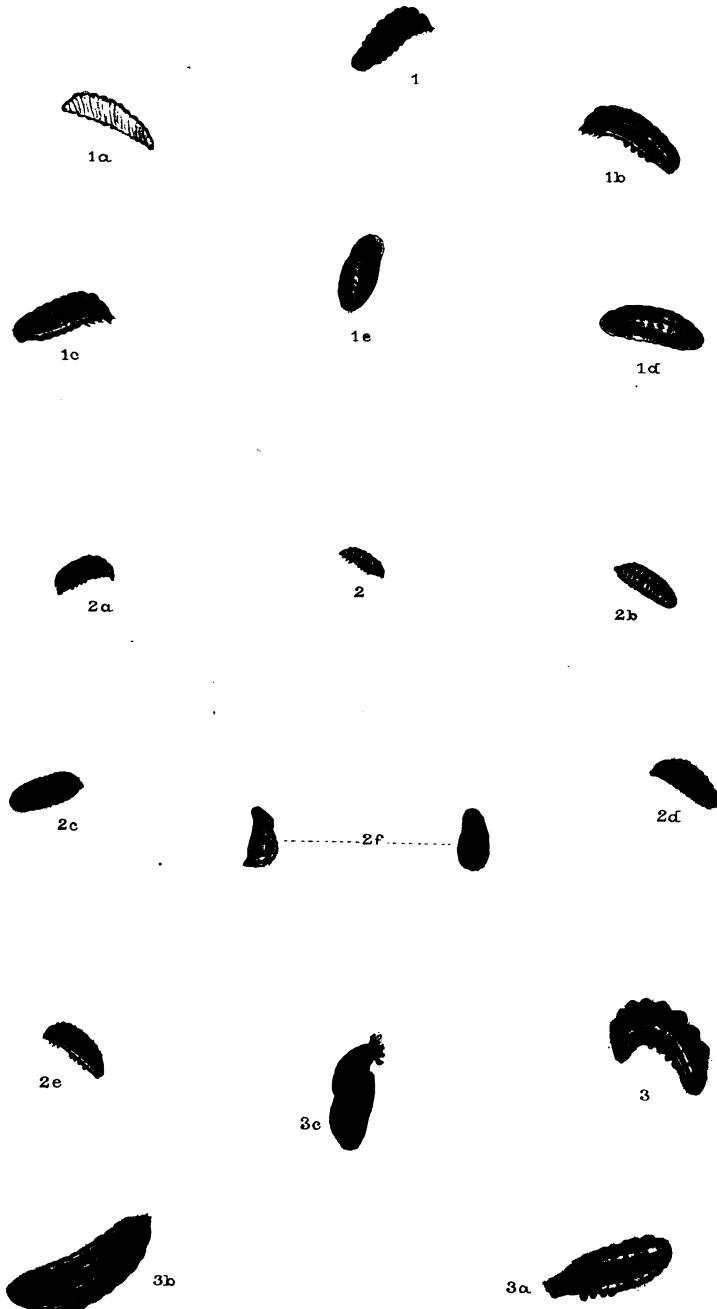
### POLYOMMATUS ALSUS.

2, larva before last moult ; 2 *a*, 2 *b*, 2 *c*, 2 *d*, 2 *e*, after last moult ; 2 *f*, pupa, side view and back view.  
See pp. 100—104.

### POLYOMMATUS CORYDON.

3, 3 *a*, 3 *b*, larva after last moult ; 3 *c*, pupa.  
Noticed under *P. Adonis* see pp. 109, 110, 111, and 191.

Plate XIV.







**PLATE XV.**

**POLYOMMATUS ADONIS.**

**1, larva before last moult ; 1 a, 1 b, 1 c, 1 d, 1 e, 1 f,  
after last moult ; 1 g, pupa.**

See pp. 106—111.

**POLYOMMATUS ALEXIS.**

**2, 2 a, 2 b, larva after last moult ; 2 c, pupa.  
See pp. 111, 112, and 191—194.**

**POLYOMMATUS ÆGON.**

**3, larva before last moult ; 3 a, after last moult ;  
3 b, pupa.**

See pp. 112—116.



1



1a



1b



1g



1c



1d



1e



1f



2



2c



2a



2b



3a



3b



3







## PLATE XVI.

### POLYOMMATUS AGESTIS (*MEDON*.)

1, 1 *a*, larva after last moult, of the typical form ;  
1 *f*, pupa ; 1 *b*, 1 *c*, 1 *d*, 1 *e*, larva after last moult of  
the northern form or variety *Artaxerxes* ; 1 *g*, pupa of  
the variety *Artaxerxes*.

See pp. 116—122.

### THYMELE ALVEOLUS.

2, 2, larva after last moult ; 2 *b*, pupa.

See pp. 123—126.

### THANAOS TAGES.

3, larva after second moult ; 3 *a*, after third moult ;  
3 *b*, 3 *c*, after fourth moult.

See pp. 126—129.

Plate XVI.







PLATE XVII.

STEROPES PANISCUS.

1, larva after second moult ; 1 c, after third moult ;  
1 a, 1 b, after fourth moult.

See pp. 129—134 and 194, 195.

PAMPHILA ACTÆON.

2, 2 a, larva after last moult ; 2 b, 2 c, pupa.

See pp. 135—138.

PAMPHILA LINEA.

3, 3 a, 3 b, larva after last moult ; 3 c pupa.

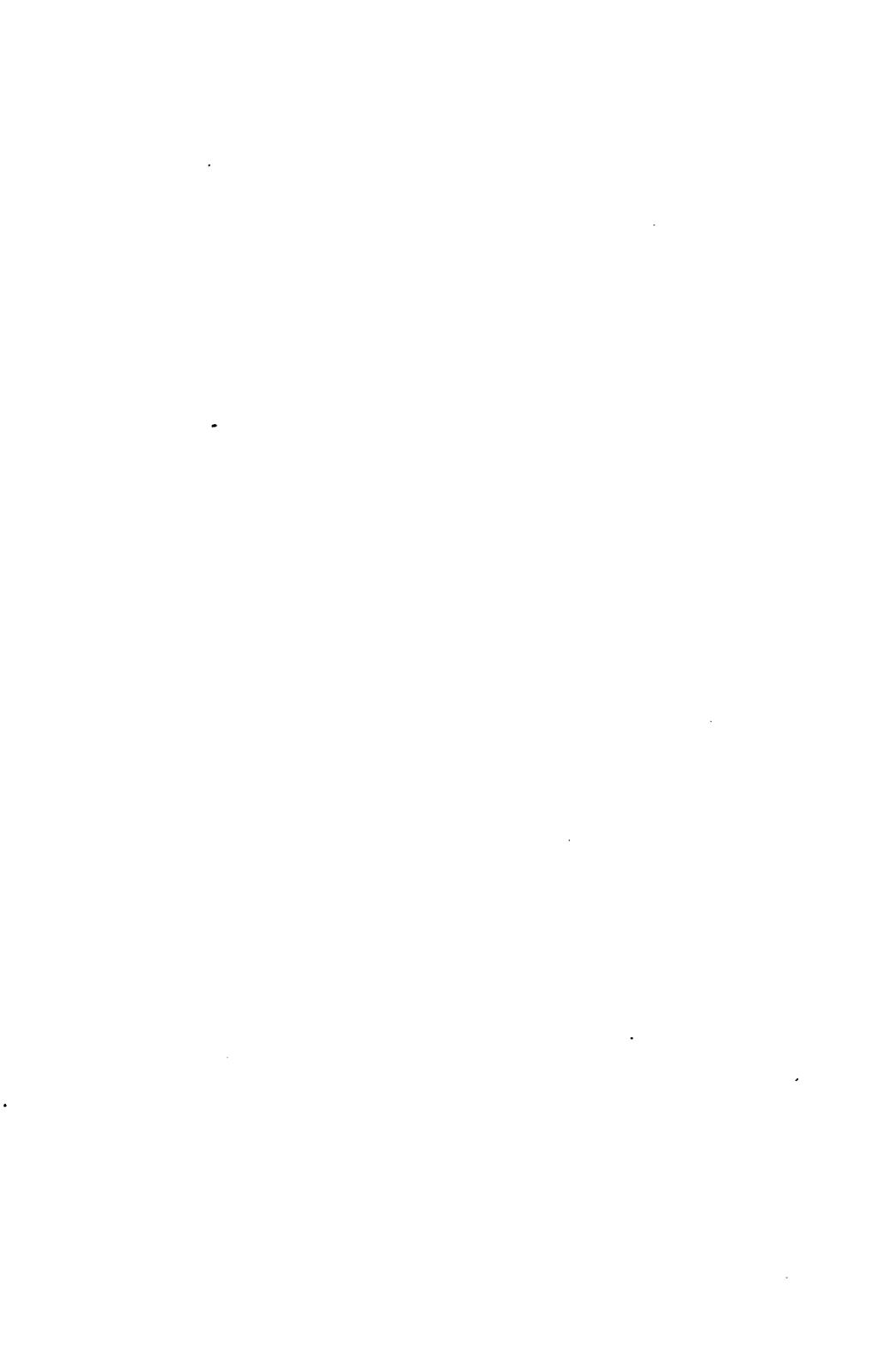
See pp. 139—141 and 195, 196.

PAMPHILA SYLVANUS.

4, 4 a, 4 b, larva after last moult ; 4 c, pupa ; 4 d,  
folded leaf of *Luzula pilosa* containing a pupa.

See pp. 141 and 196—198.





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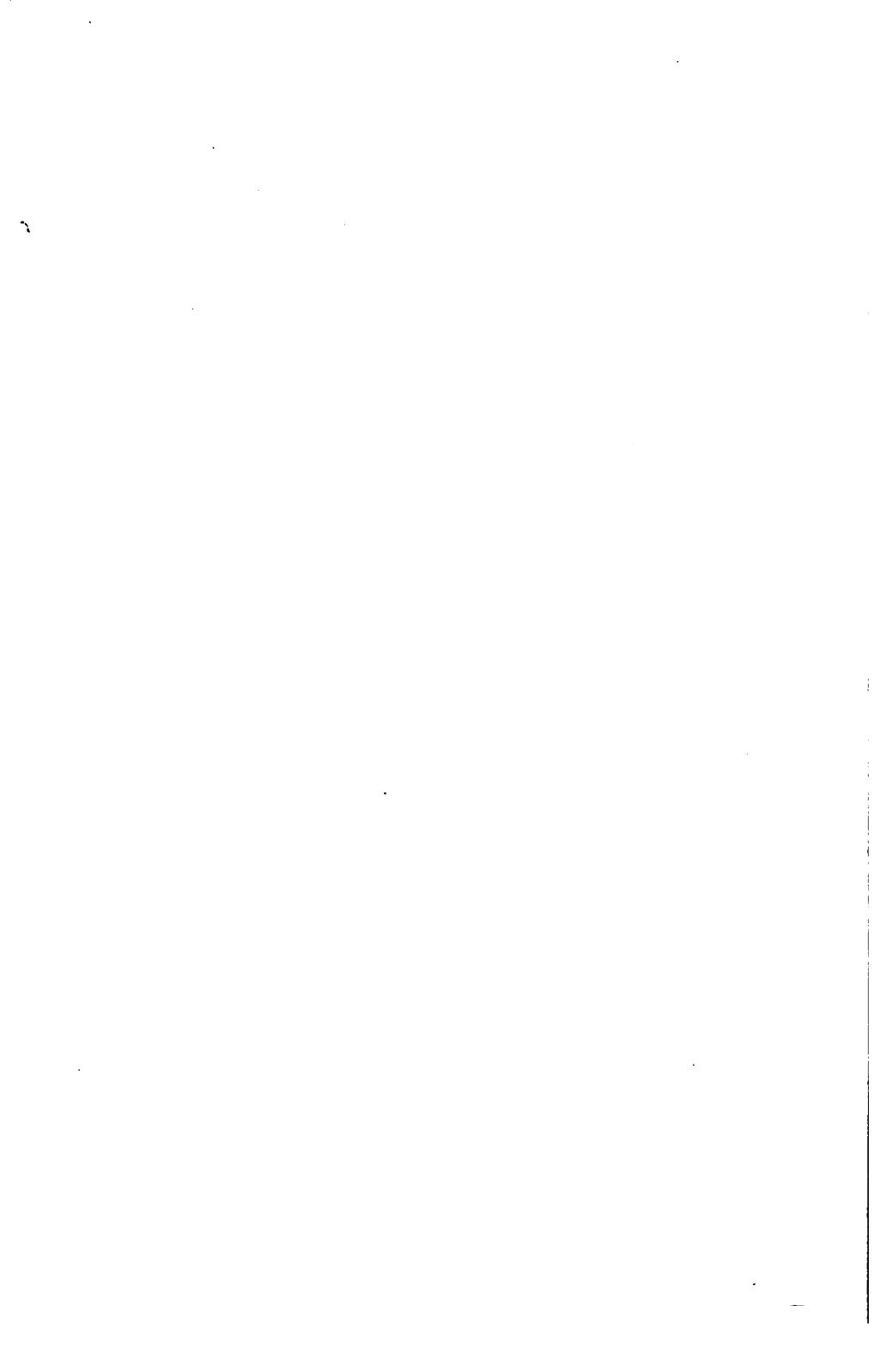
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